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PUSA

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THE INTERNATIONAL INSTITUTE OF AGRICULTURE

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a) Collect, study, and publish as promptly as possible statistical, technical, or economic information concerning farming, vegetable and animal products, the commerce in agricultural products, and the prices prevailing in the various markets.

b) Communicate to parties interested, also as promptly as possible, the above information.

c) Indicate the wages paid for farm work.

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The Canadian abstracting is by Mr. T. K. Doherty, chief of the Canadian Bureau of Correspondence with the International Institute of Agriculture.

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VI. — INJURIOUS VERTEBRATES.

1382 The Food of the Starling and the Skylark.

NB. The intelligence contained in the present Bulletin has been taken exclusively from the periodicals, bulletins, and other publications which have reached the Library of the International Institute of Agriculture in Rome during the months of July and August 1912.

The Bureau assumes no responsibility with regard to the opinions and the results of experiments outlined in the Bulletin.

The Editor's notes are marked (*Ed.*).

AGRICULTURAL INTELLIGENCE

GENERAL INFORMATION.

1253 – **The Mission for Economic Studies in Morocco.**

1. MALET, E. Enquête agricole.
2. GEOFFROY-SAINT-HILAIRE. L'élévage des animaux domestiques dans la région Nord-Ouest du Maroc. — *L'Afrique française*, 22ème Année, No. 7, pp. 252-261. Paris juillet 1912.

DEVELOPMENT OF AGRICULTURE IN DIFFERENT COUNTRIES

AGRICULTURAL ENQUIRY.

M. Malet, the Chief of the Secretariate of the General Direction of Agriculture, Commerce and Colonies for Tunis, sums up his observations as follows:

As regards the agricultural question, the enquiry opened by the Morocco Committee was to deal with the following two principal points:

1. Inventory of the agricultural resources of the regions visited by the mission.

2. Contribution to the study of the agricultural possibilities of the same regions.

I. *Inventory of the agricultural resources.* — For each of the three districts traversed (Gharb, Beni-Ahsen and Cherarda) the inventory is carried out by taking as a basis the geological distribution of the soils, to which the natural flora of the grazing lands and the distribution of crops are naturally subordinate. This conception is moreover justified by the close relation existing between certain beds, the distribution of ways of communication, human aggregations and the places where springs occur. Each geological formation gives rise to the following investigations:

1. Botanical determination of the predominating wild plants which are consequently capable of: (*a*) characterising the geological formation; (*b*) giving information as to the value of the soils passed through; and, if need be, as to the possibilities of clearing.

2. Taking samples of soil with a view to determining by analysis the physical and chemical properties of the arable soil and drawing up by way of reasoned generalisation a large scale agronomic map.

3. Sampling the water of the principal permanent wadis (wadi Sebou, wadi Beth, wadi Redom, etc.), with a view to arriving, according

to the degree of mineralisation and the nature of the constituent salts, at an enumeration of the crops capable of cultivation by watering and irrigation.

4. Examination of the plantations and standing crops from the several points of view of present production, methods of cultivation and resistance to disease.

5. Sampling agricultural produce on the markets for the purpose of expert examination and determining by comparison with similar products: (*a*) their industrial value · (*b*) their commercial value for exportation.

6. The methods and processes in use by existing agricultural industries (oil-making, semolina production, fruit-drying, etc.) and the improvements of which they appear capable in the present state of affairs.

7. The conditions of agricultural association for farming purposes.

Up to the present the number of samples taken is: 70 of soils; 6 of waters, and 23 of agricultural produce (durum wheat, barley, bere barley, beans, sorghum, chickpeas, etc.).

The analysis of the samples of soil will be effected through the agency of the chemical laboratory of the Institut National Agronomique in Paris. The specimens of agricultural produce will simultaneously be subjected to examination by the Colonial Institute in Marseilles, the School of Agricultural Industries of Douai and the Agricultural Institute of Gembloux in Belgium.

By their external characters the varieties of durum wheat and barley exhibit very genuine qualities, both from the point of view of industrial value and that of resistance to fungus diseases (rust and smut). On the other hand the beans, sorghums, lentils, and the majority of the fruit varieties appear to be in need of methodical selection and perhaps even replacing by better varieties to be imported and acclimatised in the agricultural experiment establishments, which would furthermore serve for a study of extensive farming crops and questions relating to the working of the soil.

II. *Contribution to the study of agricultural possibilities.* — The data for this study are to be found in the observations and reflections suggested by a general examination of the particulars referred to above, which it is unfortunately impossible to supplement by sufficiently precise information regarding climatology and above all rainfall measurements.

On the other hand, again, in the proposals and formulated suggestions which will form the conclusion of this enquiry, it will seemingly not be uninteresting to allow for the present position of the French market, which appears likely to be thrown open, in part at least, for the admission duty-free of Moroccan produce. Many and varied circumstances have contributed to placing certain crops in the home country, particularly vines, in a position bordering on over-production, and it would be imprudent to

guide colonial farmers in a direction which did not have for its essential object the importation of produce peculiar to hot countries and in some sort supplementing that of the mother country. No doubt this consideration cannot suffice to put aside all concern for securing markets abroad and supplying the local market more fully, but it nevertheless retains, in relation to this question, an importance which would be brought out more strongly, if need be, by the economic history of Algeria and Tunis.

The conditions of environment (climate and soil), however, happily lend themselves to a solution which is calculated to satisfy all the opposing interests and is based on the introduction or development of the growing of cotton, beets, maize, sugar, sorghum, oil plants and forage crops, for which the richness, even of dry soils, of certain regions of the Gharb, the Beni-Ahsen and the Cherarda presents indisputable advantages. Besides this, irrigation, which is at many points feasible under excellent conditions, will lend itself in a most practical and alluring way to the establishment of intensive farming and the agricultural industries normally associated therewith (sugar and oil works, cotton ginning works, etc.).

In one and the same natural region (Gharb—Beni-Ahsen—Cherarda) all conditions of climate remaining the same, the productive capabilities depend on several factors, some natural, others economic, which regulate the specialisation of crops and determine the guiding formulae to be adopted in the settling of colonists. From this point of view, without anticipating the results to the enquiries at present in progress, it is nevertheless possible to characterise, by way of general outline, the regions visited by the mission :

1. *Gharb. a*) *Coast region.* — This is a pliocene formation with sandstone predominating, yielding light agricultural soils, sandy, and poor in phosphoric acid and lime. Under present circumstances it is a live stock, barley and millet region. Development will be possible by means of fruit crops (olive, carob, almond, fig, etc.), with interculture of barley and oats during the period preceding the coming into bearing of the plantations. It is a region especially fitted, owing to the nature of the commonage, for extensive sheep breeding. Other agricultural speculations to be tried would be : the fibre-yielding agave, castor-oil plant, geranium, etc. The colonisation should be considered in lots of large area (from 2500 acres up) because possible farming undertakings will involve large investments of capital yielding little during the first few years. In plantations of any extent olives only become fully productive about the eighteenth or twentieth year, and carobs the twelfth or fourteenth year ; for each a total expenditure of about £8 per acre must be allowed.

b) *Basin of the Wadi Mda.* — A miocene formation. A succession of gently sloping hills almost wholly cultivable. Soils of a clayey or loamy nature adapted for growing wheat, barley, maize, sorghum and chickpeas.

After improvement by drainage and ploughing in narrow lands, it will be possible, in the actual valleys of the Wadi Mda and the Wadi Segmet, to bring under cultivation excellent land at present abandoned as commonage owing to its excess of moisture. The region is well fitted for breeding cattle and horses. Possible improvements: introduction into the rotation of forage crops, leguminous crops (fenugreek), hoed crops (cotton, beets and maize) and soft wheat.

c) *Basin of the Wadi Sebou* (*right bank*). — An alluvial formation, clayey and sandy loams, fertile, deep, and suitable for the improvements advocated in the preceding paragraph.

Colonisation in farm lots of 250 to 750 acres according to position.

2. *Beni-Ahsen. a*) *Basin of the Wadi Sebou* (*left bank*). — An alluvial formation presenting the same characteristics as that of the right bank. Region of good fertility but nevertheless some areas near the junction with the Wadi Ouarra would, in order to be put under European crops, require the clearing of pretty numerous thickets of wild jujube trees and would entail expenses depriving them of all interest for the moment. On the other hand, drainage and irrigation by elevating machines along the bank would enable the reclamation of extensive areas at present poorly productive as commonage land.

b) *Basin of the Wadi Tifelfelt.* — This is an alluvial formation of a sandy nature, in the same way and to the same extent as the coast zone of the Gharb. It is suitable for farms based on the growing of fruit crops and extensive sheep raising. The Wadi Tifelfelt, with a small flow of water in the dry season, is of no great interest for irrigation.

c) *Basin of the Wadi Beth.* — Deep alluvial loams, fairly fertile and suitable for all extensive farm crops and capable by rational cultivation of supplying yields notably in excess of the normal. Without any further innovation, the mere adoption of the preparatory ploughings of which the efficacy has been proved in the cereal-growing regions of Algeria (Sétif, Bel-Abbès) and Tunis (Mateur, Béjà, Medjez-el-Bab) appears likely to increase the yields by 25 to 30 %. Increase will be possible subsequently by the introduction of phosphatic manures and the improvement of crop rotation by alternation with leguminous crops to fix atmospheric nitrogen, and hoed crops to get rid of the parasitic weeds.

At certain special points, but not over the entire area of the Merja, there is a possibility of drainage work and irrigation by barrage reservoirs or diversion barrages, works which promise to double the productivity of the lands in question. As a whole, this region holds out good prospects for growing cotton, sugar beet and flax.

Intensive breeding of cattle could be carried on in the Merja after some work of equipment and arrangement.

d) *Basin of the Wadi Redom.* — This is an alluvial region of exceptional fertility destined to undergo very great economic development by the introduction of rich selected crops. It is remarkably well adapted for growing maize, sugar beet and cotton, and for this latter plant it does not seem excessive to anticipate results of 8 to 10 cwt. of Mitafifi (Egyptian cotton) per acre without irrigation, after clearing of couch grass and the adoption of dry-farming methods ; with irrigation (a reservoir barrage is possible in the gorge of Sidi-Kassem) and by organic and mineral manuring this yield may be raised to 12 or 13 cwt. It would be interesting to try also the variety Mitafifi-Abassi-Yanovitch and in a lesser degree the Mississipi.

3. *Cherarda. a*) *Basin of the Wadi Redom.* — This region is part of the same formation as the previous one, from which it cannot, from the agronomic standpoint, be separated ; it also seems favourable in all ways to great economic development.

b) *Mountainous region.* — This is formed of a succession of round-topped hills and gently sloping plateaux extending by successive rises between the left bank of the Sebou and the ridge of the Seffat and Zegotta chain. The valleys of the Wadi Zegotta and its tributaries recall in point of fertility the fine soils of the upper valley of the Wadi Redom. They are marly limestone soils, deep and suitable for cereals, beans, the so-called spring crops, hemp and forage crops, which will supply the animals with the food which cannot be permanently yielded by natural pasture land seldom fit for mowing.

Finally, generally speaking, the three regions visited present qualities adapted for fruit-growing and market gardening.

Breeding Domestic Animals in the North-West region of Morocco.

The breeding of domestic animals, which is quite in keeping with the character of the natives, possesses inexhaustible sources among the tribes of the Khlot, the Gharb, the Beni-Ahsen and the Cherarda, and forms the most considerable item of public wealth. Despite these favourable conditions, breeding is far from reaching full development, and exhibits a shortage of flocks and herds as compared with the quality and abundance of grazing land. It may be estimated that this region of North-West Morocco scarcely supplies one quarter of the number of head of animals it could produce. The principal reasons to which this state of things is due are : The insecurity, carelessness and adherence to tradition on the part of the breeders, the limitation of exportation of horned cattle and the prohibition of exportation of horses and sheep.

The Horse. — The horse, although represented by types resembling the different varieties of barbs in Algeria or Tunis, is at times found to differ slightly from them, but even these differences are only due to the food or climatic conditions of certain regions. The Moghreb horses, often bigger and heavier than those of some Eastern countries, present the same qualities of endurance, though they are often less energetic and more exacting as to food. The physical defects, consisting of the head being at times too heavy with a poor neck, a short and low croup, and hocks placed too high, are often made up for by the qualities of a short and well-joined loin and a high and deep chest.

In Morocco the breed of horses, which presents all the elements of a large production, is only worked for supplying the strict needs of the immediate breeders. Beyond the common or defective horses put on the market for use as beasts of burden, it is by no means easy to procure animals capable of making a good pace, except in consideration of a price often excessive. The native possesses none but the vaguest notions of improvement or selection, and has recourse by preference for his brood mares to stallions enjoying high repute either owing to their qualities or the titles of their owners. In this choice no allowance is made for the faults or blemishes of the sire, whose work is frequently terminated or completed in the grazing field by the first horse which has succeeded in breaking away from its tether.

The defective and limited production of horses even now presents disadvantages which, at an early future, may become real dangers and still further complicate the horse question which is already complex, both in France and its North African colonies.

For about two years, after fifteen years of sustained effort, Tunis has managed to provide by its own means for the remount of its regiments of occupation as well as of its colonists, while leaving a fairly wide field for exports. Algeria, on the contrary, which it would seem should be an inexhaustible source of horses, is at present in an embarrassed condition, many breeders having given up this line of breeding in favour of the mule, which is safer and more paying. It is to be feared that under these circumstances the Morocco Protectorate Government, having to deal in breeding regions with a dense population with very active needs, will not be able easily to procure the remounts for its occupying troops, nor will the incessantly growing colony be able to find the means of transport or work needed for its agricultural, commercial or social life.

The Government will have to submit to great sacrifices for the provision of prompt and effective encouragement for horse breeding; the creation of studs is a positive necessity, whether these studs are undertaken by the remount service as in Algeria and Tunis, or remain in the civil sphere as there was some question of their being a few years ago in these latter colonies, and as has been done in Madagascar and Indo-China. In any case,

even if the remount service undertakes the stud department in Morocco and contributes to encouraging breeders by purchases at remunerative prices, there is reason to suppose that the War Department, supplying the stallions fit to assist in breeding remount horses, will leave the Government of the Protectorate, as in Tunis, the duty of maintenance of the sires it furnishes to satisfy the needs of the colony, the costs of the establishment and upkeep of the remount stations and the sums to be necessarily distributed by way of encouragement premiums and also those to be allotted to the Stud Book and the racing trials. These latter will be wholly native.

The breeds of which the horses of the country are made up are such that there is every reason to hope that their improvement will be easy by means of suitable barb stallions and especially Arab thoroughbreds.

The fact that all Mussulman peoples retain their horses entire forms one of the greatst difficulties to be surmounted in the improvement of their breeds. In Tunis a motion had been brought forward on this subject before the consultative Horse Commission in 1904, requiring that every owner should have his horses castrated at four years, and taxing heavily those who failed to do so, exception being made only for approved stallions. This motion, which nevertheless was well grounded, was perhaps a little late, after twenty years of protectorate, and was rejected as being an encroachment on the freedom of property.

Free export of the products of breeding is one of the most effective means for increasing propagation and amelioration of the breed, while it may seem premature in relation to a limited stock of animals.

In Tunis the best results were obtained by putting an almost prohibitive customs duty on the export of horses less than five years old and mares less than seven years old. It was in truth objected that these taxes only restricted the exportation of mediocre animals and that they were a matter of indifference to buyers of animals of quality; experience, in any event, proving the contrary to be the case, has shown that this measure was well founded.

Mules. — Among mountain populations whose regions are difficult of access, and who therefore count the mule as their most valuable auxiliary, the mares are without exception devoted to their production. In the plains mule breeding is only practised in so far as required by agricultural needs. The Moroccan mule, which resembles its Algerian fellow, has, of late years, like the latter, undergone an increase in price which has almost doubled its value as against three years ago.

Algerian mule production, though considerable, has almost been exhausted by the successive campaigns of Madagascar and Morocco, the more and more pressing demands of Spain and Tunis, and calls from South Africa, as Argentina is unable to supply them any longer in consequence of the recent agricultural development of its immense territories. Under

these conditions Algeria, over-run by buyers, will maintain a permanent rise of price for its mules. These prices have a perceptible reaction on the entire North African coast, especially on Morocco, where military operations and the development of the country will form sufficient encouragements for mule breeding.

Cattle. — The cattle in Morocco have perfectly constant racial characters ; the coat has a red ground, the face is straight, and the horns are white or light at the base and always black at the ends, expanding in the form of a lyre or crown ; the beasts possess very great fineness of meat, and marked fatting properties, and often reach 3 ft. 11 in. to 4 ft. 1 in. in height at the withers, while the Algerians hardly exceed 3 ft. 7 in. to 3 ft. 9 in.

The cows are relatively good milkers, yielding 1 ½ to 2 gallons per day. The average yield of butcher's meat is 50 % of the live weight in 6 cwt. beasts, while the yield of other oxen in North Africa does not exceed 47% on average 5 cwt. beasts.

These qualities and well fixed characters suffice to classify the Moghreb cattle as a special breed in relation to their congeners and give them a well-established reputation which causes them to be in demand both by farmers in search of ploughing oxen and by dealers for the needs of consumption.

Cattle breeding is most important and most successful in the North-West region. It is true that from the point of view of the character of the native and the conditions of insecurity under which he lived, this industry, easy of transfer from place to place, met his needs. Demanding no care, in a very temperate region possessing rich pasture land, a very abundant water supply and constantly high humidity, the best natural conditions were combined to ensure success.

There is no doubt that the Moroccan breed, if well looked after, having at its disposal shelters for inclement weather, artificial fodder for periods of drought or excessive moisture, and subjected to reasoned selection, will improve both rapidly and considerably. These conditions of improvement may be the result of contact of the natives with the colony and also may be brought about by the Government, which must afford encouragement thereto.

The exportation of cattle, reduced to 10 000 head per annum for each of the seven legations which existed at Tangiers, never served any other places than Gibraltar or Spain and to some small extent Algeria, which profited by its close proximity. At the present time, according to enquiries made, the consumption of cattle in Morocco may be approximately estimated at 300 000 head per annum, which requires a stock of three millions at least. This production, however extensive it may appear, is capable not merely of improvement but of increase when reasoned agricultural methods in combination with hydraulic work

shall have supplied this magnificent country with the elements of its true productiveness.

Morocco, throwing open its gates for the exportation of its cattle, will see the advent of an extensives business movement. It is even probable that at no very remote future meat exported in any form, alive, cold-stored or manufactured, will be able to compete in part with South American products which tend to make their way into the French market, and to participate in the solution of the problem of the high cost of living.

Sheep. — The sheep of the North-West region present very particular characters which, as in the case of the cattle, cause them to be classed as a special breed. Profile straight in the ewe, clearly arched in the ram; these animals from their earliest days carry a deep dewlap, a fold of skin beneath the neck extending as far as the fore legs and sometimes beneath the chest. These special features of face and skin mark a close kinship with the merino, which has itself sprung from North Africa, and indicate an aptitude for the utmost wool production. The wool, which covers the cheeks and sometimes reaches to the forehead, comes low down on the fore and hind legs, always presenting appreciable fineness and particularly perfect homogeneity of staple ; these are qualities in demand in industry, as attested by the extensive trade done in the wool produce of the country by large French and English firms. The meat, of very good quality, gives an average yield of 45 % of the live weight.

The flock is abundant, but generally neglected, the prohibition of all exportation resulting in its only being worked for its industrial products, milk, skin and wool.

In the North-West the sheep stock is relatively less than that of cattle, and many grazing lands, of considerable extent, which would be especially suitable for the former, are unoccupied, while wet regions unsuited for their breeding contain cattle and sheep without distinction. This fact is due to the insecurity which compels the grouping of all flocks and herds at a given, often limited, point. The natives do a very small trade in mutton, and, except for their own consumption, for which they prefer beef (save on the approach of the great religious festivals which render the sacrifice of these animals obligatory), even the most important markets are almost empty of sheep, while on the contrary they are loaded up with wool and skins.

The local breed, essentially wool-bearing but neglected as to its meat production, will be best and most effectively improved by rational feeding and selection. If crossing is allowed, to expedite matters, only the Crau merino should be chosen. This will not even be a crossing but improvement by means of products previously selected. The examples in the colony, the coming of the meat traders and the creation of industrial establishments treating the meat direct, will easily bring home to the breeder

the fact that without any detriment to his traditional production of wool and skins, he must leave the ewe's milk to the lambs in order that they may reach normal growth. The prices will inmediately be higher and will by that very fact constitute an encouragement for better production. The sheep industry has contributed so much to the prosperity of Algeria that there is full justification for looking forward to the same success in a country which contains superior elements to start with.

Under whatever form Morocco sheep are brought into the commercial current of consumption and export, whether alive, cold-stored or manufactured, their condition is not yet sufficiently fixed in growth to allow at the pr sent time of permanent transactions. To ensure rational growth, slaughtering and exportation of sheep should be prohibited from the 15th of July to the 31st of December in each year, thus guaranteeing gestation and lambing.

Without desiring to pass a premature judgment, there is nevetheless every reason to think that what has just been said as to the sheep of Gharb, Beni-Ahsen and Cherarda applies in no less a degree to the sheep of the mountainous regions. The conclusions proposed by M. Geoffroy-Saint-Hilaire, Inspector of Breeding in Tunis, are:

Horses. — Creation of studs (encouragements to horse-breeding urgent), limitation of the exportation of young horses and mares.

Cattle. — Encouragements for the improvement of the native race (artificial forage and shelters), and free export.

Sheep. — Encouragements for improvement, importation of Crau merinos, and exportation free for males and limited as to females.

Creation of breeding departments. Study of contagious diseases. Sanitary Services. Creation of abattoirs in big towns. Supervision of suburban and rural abattoirs.

RURAL HYGIENE

1254 – Epidemiology of Tuberculosis.

CALMETTE, A. Enquête sur l'épidémiologie de la tuberculose dans les colonies françaises. *Annales de l'Institut Pasteur*, 26ème Année, N°. 7, pp. 497-514. Paris, juillet 1912.

As regards the epidemiology of tuberculosis in countries outside Europe, there are only available a few statistics prepared by Römer in Argentina, some facts put on record by Peiper in German East Africa, and the observations methodically carried out by Dr. Wagon in French Guinea and Dr. Nöel Barnard in Annam. The Author thought that it would be useful to extend this enquiry and to undertake it simultaneously in the largest possible number of French colonies, inasmuch as the particulars thus gathered throw light on the various methods of infection. For instance they may serve to settle the vexed question of the relative importance of bacilli of bovine origin in human infection.

The data here reproduced were collected by the Army medical officers with colonial troops, the medical officers attached to the native assistant services and the staff of the colonial Pasteur Institute. As the diagnosing process the test of tuberculin skin reaction was adopted. The results of the enquiry (general averages) are given in the following table:

	Number of subjects observed	Number of positive reactions	Percentage of infection
	—	—	—
West Africa:			
Senegal	2737	431	15.1
Guinea	396	7	1.8
Ivory Coast	816	76	8.4
East Africa:			
Madagascar	1022	72	7.0
Réunion	1244	652	52.4
North Africa:			
Algeria	436	118	26
French Colonies in America:			
French West Indies	1405	577	41
French Colonies in Asia:			
Tonking	1680	527	31.4
Annam	3009	1149	38.1
Cochin China	332	53	16
Cambodia	411	19	4.6

As regards bovine tuberculosis, it does not exist throughout West Africa. In Madagascar it is not found in the Northern provinces, while on the other hand those of the South are seriously infected and the infection tends to spread towards the centre of the island. At Réunion (where human tuberculosis is as common as in the large French industrial cities) bovine tuberculosis is very widespread; in the French West Indies it does not exist or is extremely rare; in Indo-China, it is unknown everywhere except in Cambodia, where it has been recorded on animals imported from Europe.

Tuberculosis recently imported by Europeans is to-day causing terrible ravages throughout the Pacific islands. Is seems as though the tuberculous infection in each island is proportional to the number of Europeans. The natives of the Polynesian race do not drink cow's milk. For the rest, cattle are of very recent importation into their islands and breeding is still carried on there on a very limited scale.

Conclusions. — " In tropical regions tuberculosis is not noticeably influenced by climate. Its frequency is in a direct ratio to civilisation. It is extremely rare among native populations of black race, in countries where the European has only penetrated within a few years; the proportion

of persons infected however increases with the intensity of trade and foreign immigration."

None of the races peopling French colonies " presents immunity against tuberculous infection. All on the contrary show a sensibility to it which is greater in proportion as they were recently better protected against the importation of the bacillus. The races showing the greatest liability to tuberculosis and among whom it takes its most rapidly fatal forms are those most recently in contact with civilisation : Polynesians in Oceania and negroes of the African Hinterland." In the Old Colonies of Réunion and the West Indies tuberculous infection is almost as intense as in large European cities.

In Colonies of more recent date it is found that the number of infected subjects progresses wherever European establishments have been created and that, conversely, the forms of tuberculosis observed are less grave in proportion as the infection is more widespread and older.

These facts show that those human beings who are born and have grown up sheltered from tuberculous infection become infected with the utmost facility when exposed to contagious contact. Furthermore, tuberculosis almost constantly assumes grave forms with them (granulated or galloping consumption). On the other hand, where the bacillary infection has long been spread, contamination takes place from early youth and the forms of tuberculosis observed are almost always chronic.

According to the results of the enquiry it is no longer possible to maintain the hypothesis formulated by Von Behring in 1903, that pulmonary tuberculosis in the adult is only the tardy manifestation of an infection, mostly of bovine origin, contracted in the early months of life in consequence of the ingestion of cow's milk containing bacilli.

It is observed in the first place that among the native populations of West Africa for instance, which are little attacked as yet, or among those of Indo-China which suffer more, children are constantly found immune until weaned. Only at that time are they presented with opportunities for infectious contacts ; the infection spreads with extreme facility, much more often through the digestive channels than through the respiratory passages.

In West Africa, the West Indies, Indo-China and Oceania the bovine origin of tuberculosis cannot be alleged or even suspected, inasmuch as young children never drink cow's milk and the native cattle, where there are any, are still completely free from tuberculous infection.

This means that in those countries interhuman contagion alone operates.

1255 - **Agricultural Education in Greece.**

CHASSIOTIS, S. (Director of Agriculture in the Ministry of Agriculture of Greece). L'Enseignement agricole en Grèce. — *La Vie Agricole et Rurale*, No. 24, pp. 646-648. Paris, 11 mai 1912.

The first school of Agriculture in Greece was founded by the Count of Capodistria in 1829 on the national domains of Tyrinth, a small village situate near Nauplia, this city being at that time the seat of government. Its management was entrusted to a young Greek agriculturist, Gregory Paleontologos, a former pupil of Mathieu de Dombasle.

The programme and object of the Tyrinth school were the same as those of the farming school at Rouville, where its director had studied, that is to say, instruction in the best methods of cultivation for young men devoting themselves to agriculture ; making known the most important agricultural implements at that time, developing agricultural industries, wine-making, oil manufacture, the introduction of new plants, the improvement of fruit trees, the best methods of propagation, etc. The farming school at Tyrinth continued in operation for some thirty years more or less regularly according to political vicissitudes, and on the Revolution of 1862 it was closed, legislators at that time being concerned chiefly with commerce and navigation.

After the closing of the Tyrinth school the progress of agriculture was arrested for some time. Not until 1881, after the transfer of Thessaly to Greece, did the development of the rich and fertile plains in that province bring home to the nation the urgent need of re-establishing the agricultural departments. Therefore in 1887 there was formed in the Ministry of the Interior an Agricultural Division, which led in the following year to the foundation of two schools of agriculture the programme of which differed little from those of the practical French schools. One of these schools, in Athens, occupied itself chiefly with fruit-growing, whilst the one at Aidini (Thessaly) was aimed at extensive farming.

A little later on, in 1891, an agricultural station was created at Vytina in the centre of the Peloponnesus. In view of the results attained, the legislature in 1897 decided on the creation of agricultural stations in each department and even provided for sub-stations in certain districts according to available funds in the budget. Ten stations worked thus until 1911, in Athens, Aideni (school), Patras, Tyrinth, Vytina, Corfu, Gastonni, Missolonghi, Levadia, and Calamota, as well as four or five sub-stations. These stations, or rather model farms, possessed a demonstration field where all improvements in cultivation were to be practised. Furthermore lectures were to be held at the principal centres.

The instruction was also ably seconded by private institutions. In 1907 there was founded in Cephalonia a farming school intended for agricultural education in those regions. This school, created under the Val-

liano bequest, receives a grant of 40 000 francs per annum from that bequest.

The Agricultural Society, under the presidency of His Majesty the King, possesses model farms in Athens, Aigiou, Calamas, Jarsala and Pyrgos.

In 1910, under the stimulus of public opinion, which had been enlightened by the Union of Greek Agriculturists, the Government decided to create a Ministry of Agriculture, the need for which was strongly felt. This Ministry was entrusted with the departments of mining, forestry, commerce and labour, and it is denominated the Ministry of National Economy.

The Department of Agriculture comprises several sections, each having a specialist at its head.

The Chambers have already passed several laws intended for the improvement of agricultural instruction.

At Larissa, Thessaly, there has been created a new theoretical and practical school of agriculture, the costs of installation of which, amounting to nearly a million, were covered by the Averoff legacy. The budget for this year (1912) amounts to 150 000 francs ; it is provided by the direct revenues of the school and a State subsidy of 60 000 francs.

To this school there are attached, as administrative and teaching staff : 6 lecturers, 3 assistant lecturers and 3 practical instructors. The pupils, numbering 60, are resident.

The school has two sections ; the programme of the higher section is somewhat more advanced than that of the practical schools of agriculture in France ; the duration of studies is three years, with three hours of theoretical instruction and five hours of practice per day, during which the pupils are trained in all branches of agriculture. The pupils of the lower section are recruited from among young men of the rural population, and are limited to practical work only. The object is to turn these young men into excellent agricultural labourers.

For popular education, 10 departmental lectureships have been established, one in the chief city of each department ; they are under the direction of an agriculturist who has qualified in a higher school in Europe (Institut agronomique, Grignon, Gembloux, etc.), who is seconded by two assistants qualified in the practical schools in Greece.

The programme of these professors comprises popular lectures in the principal centres, courses to the pupils of secondary and normal schools, agricultural investigations and preparation of statistics.

For demonstration and studies on the soil, production and propagation of selected seeds, fruit trees, forest trees, etc., four of the old agricultural stations have been retained, with a perfectly definite programme of work to be followed out by each.

Athens, general fruit-growing, vine-growing and wine-making.

Patras, a large fruit nursery.

Tyrinth, farming and lowland cattle-breeding.

Vytina, mountain cattle-breeding and the dairy industries.

The number of sub-sections (demonstration fields) has been increased, 1 to 2 per department.

Provision is also made in agricultural communes for the creation of school gardens ; 100 are already at work, and the Ministry hopes for much from this education, manual and *de visu*, given to rural children.

Fruit-growing, forming a very important branch, has been entrusted to foreign specialists holding Versailles diplomas. For some crops, tobacco, coffee, olive, etc., the department has secured the co-operation of specialist workmen ; thus 11 Italian olive-pruners travel through the different provinces and show the best methods of pruning in practice.

The veterinary department also has, in each chief city, a surgeon having special charge of cattle and meat inspection and measures to be taken in the event of cattle diseases.

Four studs are installed in the dependencies of the stations at Athens, Tyrinth, Gastanni and Larissa. Plans for the creation of a laboratory of veterinary microbiology, stations of plant diseases, silk-worm breeding, oil production etc., are under examination.

1256 - **Work of the Division of Horticulture of the Central Agricultural Station of Mexico in 1911.**

CALVINO, MARIO. (Trabajos diversos ejecutados por la Division de Horticultura de la Estacion agricola central en el año de 1911). — *Direccion general de agricultura. Boletin No 66 de la Estacion agricola central*, p. 82. Mexico, 1912.

Report of cultivation experiments carried out at the Central Agricultural Station of Mexico on forage plants, cereals, vegetables, flowers and fruit trees. These experiments deal with acclimatisation, manuring, determination of yield and grafting.

Catalytic manures. — On steeping maize seeds for four hours in a 1 per cent. solution of sulphate of iron more vigorous plants were obtained. Similar results were given by beans. When maize seeds were immersed for five hours in a 2 per thousand solution of boric acid they also gave more vigorous and healthier plants.

Cereals. — In some parts of Mexico and especially in Central Neseta, the early autumn frosts often seriously damage maize, beans and winter wheat. This happened in the two consecutive years, 1909 and 1910, in which all the crops were severely injured. The author therefore suggests the introduction of buckwheat and especially of *Polygonum tartaricum* var. *secalinum* into that region.

The cultivation experiments which he made gave the following results :

Polygonum Fagopyrum (Alforfón común)	14.3	cwt per acre
» *tartaricum* (Alforfón de Tartaria) . . .	19.1	» »
P. tartaricum var. *secalinum* (Alforfón centeno) . .	22.3	» »

Forage Plants. — Among forage plants the following showed themselves adapted to the climate and soil of Mexico:

Yield in cwt. per acre.

Tall oat (*Avena elatior*) and white mustard (*Sinapis alba*)	615	in 3	months
Kale (*Brassica oleracea acephala*)	641	in 5	»
Cocksfoot (*Dactylis glomerata*)	380	in 16	»
Timothy (*Phleum pratense*).	258	in 16	»
Awnless Brome-Grass (*Bromus inermis*)	256	in 16	»
Fenugreek (*Trigonella foenum-graecum*)	325	in 3	»
Sainfoin (*Onobrychis sativa*)	153	in 4	»

The author further recommends swedes, especially of the white Norfolk variety, and Sulla (*Hedysarum coronarium*).

Fruit-growing. — The author had previously adopted for eight years, whilst engaged in the reconstitution of the vineyards of Liguria, the system of severely cutting back the roots of the vines before transplanting them. He adopted the same method in Mexico also, and always with success, when planting rose trees imported from France, fig and olive trees from Italy, and about 2 000 peach trees. He therefore advises its being generally applied.

He was also very successful in cleft-grafting spineless prickly pears (" nopal sin espinas ") without using supports, on *Cereus marginatus* (" organo ") and on *C. geometrizans* (" garambullo "). Considering the ease with which the graft is made and succeeds, the author is of opinion that by means of grafting, vast tracts of land that now bear only cactuses of no use to man might be transformed into profitable cultivations.

He was equally successful in grafting the olive (*Olea europaea*) on *Fraxinus americana* (" fresno de Mexico "); the same stock suits scions of lilac (*Syringa vulgaris*) which develop upon it with exceptional vigour.

Plant diseases. — In the chapter on flower-growing, the author mentions that mildew (" mal blanco de las hojas " or " chahuixtle blanco " = *Sphaerotheca pannosa*) is very common on roses in Mexico, and that by rigorous pruning and by dusting the young shoots repeatedly with precipitated sulphur and nicotine, not only was the above fungus destroyed but also the rose-aphis (" piojo " = *Aphis rosae*).

1257 - **Agricultural Exhibitions in Russia.**

The Board of Trade Journal, Vol. LXXVIII, No. 815, p. 81. London, July 11, 1912.

Permanent Exhibition of Agricultural Machinery at Rostov. — The Imperial Don-Kuban-Tver Agricultural Society has lately decided to start a permanent exhibition of agricultural machinery and implements at Rostov, which is to be open nearly the whole year round. It will be closed from 14th. September to 28th. October, when the annual exhibitions will be held, for which special rules are laid down. The charge for space at the permanent exhibition has been fixed at about 2*s.* per square foot.

Agricultural Exhibition at Novotcherkask in 1913. — The Don-Cossack Administration has decided to hold an agricultural exhibition in 1913 at Novotcherkask. It is expected that this exhibition will attract farmers from the whole Don Territory.

1258 - **International Exibition at Kiev in 1913.**

The Board of Trade Journal, Vol. LXXVIII, No. 817, p. 218. London, July 25, 1912.

An International Exhibition of Industry, Agriculture and Art will be held at Kiev from 27th. May to 14th. October, 1913. Sections will be included for the display of machinery, beet and sugar produce, handmade goods, construction material, alimentary products, wines and beer, road, rail and river transport, agricultural implements, etc. Further information may be obtained from the "Directeur de l'Exposition pour l'Industrie et l'Agriculture, 1913," Kiev.

1259 - **The Second International Exhibition of Aviculture at St. Petersburg from October 20 to 27 (old style), November 2 to 9 (new style), 1912.**

IIe Exposition internationale d'Aviculture à Saint Petersbourg, du 20 au 27 Octobre (vieux style), 2 au 9 Novembre (nouveau style), 1912. — *Feuille d'information du Ministère de l'Agriculture ;* XVIIème Année, No. 29, p. 4. Paris, 23 juillet 1912.

This second international exhibition of aviculture and its accessories, with a section devoted to goats and rabbits, has been organized by the Imperial Russian Avicultural Society. It consists of the following sections:

1. Farm-yard poultry.
2. Tame birds, ornamental and game birds.
3. Pigeons.
4. Singing and foreign birds.
5. The results of aviculture.
6. Rabbits and the results of rabbit-breeding.
7. Goats and the results of goat-breeding.
8. Accessories and apparatus.
9. Food, medicines, etc.
10. Literature, drawings, etc.
11. Enemies of aviculture and their control.

Intending exhibitors must send in their notifications before the 5th. (18th.) of October 1912, addressed to the "Comité d'organisation de la II^ème^ Exposition internationale d'Aviculture," Fontanka 10, Musée Impérial d'Agriculture, St. Petersburg.

1260 – **The First National Maize Exhibition in Hungary.**

RÊSZ, ALBERT. Az elsö orszagos kukoricza kiallitas. — *Köztèlek*, XXII-ik evfolyam, 55 szám, pp. 1986-1987. Budapest, 1912 Julius hó 20 - án.

The National Society of Agriculture of Hungary is organizing an extensive movement in favour of the first National Maize Exhibition, which is to take place in March 1913. It has invited about 4 600 growers of maize to take part in the exhibition and from the present moment the active cooperation of Hungarian specialists and of their scientific authorities can be counted upon, thanks to the exertions of the organizing committee.

Of late years, the Hungarian agriculturists have obtained excellent results by employing the American system of cultivating maize, notably a considerable increase in the yield and a corresponding profit. Further, the general adoption of this system would cause the improvement and selection of maize seed to be rightly valued, and would lead to much progress in Hungarian agriculture, for hitherto little attention has been paid to maize selection in Hungary, which is only now beginning to become a question of national importance.

The first National Maize Exhibition will, at the same time, offer the special attraction of an annexed exhibition of the machines used in the cultivation of maize, including both those invented in Hungary, and others of foreign origin.

1261 – **Horticultural Exhibition in Vienna in May 1913.**

Preliminary communication.

The Imperial and Royal Horticultural Society in Vienna (Kais. Kön. Gartenbau-Gesellschaft in Wien) will hold at the beginning of May 1913, in Vienna I, at 12 Kaiser Wilhelmring, an exhibition of flowers, plants, fruit trees, nursery tools, floral decorations and wreaths, apparatus for horticultural instruction, garden plans, gardening tools.

Amongst the subdivisions of the exhibition, are specially mentioned in the catalogue: the flora of the neighbourhood of Vienna and of the gardens of that city; cactuses, cycads, Bromeliaceae, orchids, species of *Caladium* and *Croton*, etc., as well as crosses demonstrating Mendel's laws. The exhibition is open to all Austro-Hungarian growers; foreigners may also exhibit, but are only eligible for prizes given by Societies.

1262 – **International Competition for Traction Engines with Ploughing Outfit, to be held at Chassart, Belgium, in October 1912.**

Communication from the Belgian Ministry of the Colonies.

The above Competition, organised by the Department of Agriculture in the Belgian Ministry of the Colonies, will take place at Chassart and will begin on the 21st. October. Besides the official tests, public demonstrations will take place on days to be fixed.

The appliances will be classified as follows:

A. Engines for drawing implements: 1) Steam, (*a*) up to 30 Brake H. P.; (*b*) above 30 Brake H. P.; 2) Petrol, (*a*) up to 20 Brake H. P.; (*b*) from 20 to 30 Brake H. P.; (*c*) above 30 Brake H. P.

B. Engines to work the implements by cables.

Practical trials in ploughing and road traction will be laid down for these machines.

1263 – **Motor Competition at Parma, June to October 1913.**

Under the auspices of the Italian Ministry of Agriculture, Industry and Commerce, the Executive Committee of the Verdi centenary celebration at Parma, the Italian Touring Club, the Italian Federation of Cooperative Agricultural Associations, and the travelling agricultural lectureships of Parma the following competitions will be held.

1. An international competition of mechanical motors for deep ploughing.

2. A national competition of agricultural internal combustion motors burning petroleum and benzine.

3. An international competition of internal combustion motors burning heavy oils.

The competitions will be held from June to October 1913. Entries will be received up to March 31, 1913 at the seat of the Italian Touring Club, 14 Monte Napoleone, Milan.

The apparatus with mechanical motors for deep plonghing will be divided into three classes according to the depth of work: 8 to 10 inches; 12 to 14 inches and beyond 16 inches.

The trials of the machines entered for the second and third competitions will include: a six hours' trial under full load, six hours' under half, and three hours' without any.

1264 – **Third International Cold-Storage Congress, Chicago, September 1913.**

Bulletin Mensuel de l'Association Internationale du Froid, 3e Année, No. 29, pp. 215-225. Paris, juin 1912.

The American Cold-Storage Association has submitted for the approval of the International Association, a programme for the Congress

which will be held in Chicago in September 1913; the following more especially concern agriculture:

The Congress will be divided into six sections:

Section I. — Liquefied gases, and units employed.

Section II. — Refrigerating plant and test methods.

Section III. — Application of refrigeration to perishable commodities:

1. Refrigeration considered as a means for storing local overproduction and afterwards supplying centres of consumption.

2. Refrigeration considered solely from the point of view of the keeping in good condition of perishable commodities, from their period of greatest production till the following season. Function of refrigeration in remedying bad harvests.

3. Relative food value of butchers' meat, fish, poultry, butter and other frozen or refrigerated products.

4. Changes caused by cold in the physical and chemical constitution and morphology of perishable commodities such as butchers' meat, fish, poultry, eggs, milk and its products, fruit and vegetables.

5. Application of cold to the manufacture and improvement of solid and liquid food products.

6. Application of cold to the keeping of seeds and plants from year to year.

Section IV. — Application of refrigeration to industries: Storage and manufacture of tobacco and its products. Function of refrigeration in the preparation of leather, including tanning. Function of refrigeration in the manufacture of textile materials, including the operations on the raw material. Horticulture and floriculture. Cold in the industry of fatty substances. Rubber and its derivatives. Medicinal products, extracts and flavourings.

Section V. — Application of refrigeration to transport: Study of cold transport of perishable commodities by steamer and boat. Methods of pre-refrigeration. Methods of protecting perishable commodities against the effects of winter frosts. Laws and regulations for the transport of perishable commodities.

Section VI. — Legislation and administration: State control of refrigerated and frozen products in national and international trade. Encouragements to the cold-storage industry, granted by national and communal authorities. The action which may be exercised in the cold-storage industry by groups representing general interests, such as chambers of commerce, agricultural and co-operative societies etc. Special education for the cold-storage industry.

1265 – **International Geological Congress. XII Session, Canada, 1913.**

(Communicated by the Executive Committee of the Twelfth International Geological Congress).

The International Geological Congress, on the joint invitation of the Government of Canada, the Provincial Governments, the Department of Mines, and the Canadian Mining Institute, will hold its twelfth meeting in Canada during the summer of 1913. It is proposed to hold the meeting of the Congress in Toronto, beginning on or about the 21st. August. The Congress will continue in session for eight days.

The following topics have been selected by the Executive Committee as the principal subjects for discussion :

1. The coal resources of the world.
2. Differentiations in igneous magmas.
3. The influence of depth on the character of metalliferous deposits.
4. The origin and extent of the pre-Cambrian sedimentaries.
5. The sub-divisions, correlation and terminology of the pre-Cambrian.
6. To what extent was the Ice Age broken by interglacial periods?
7. The physical and faunal characteristics of the Palaeozoic seas with reference to the value of the recurrence of seas in establishing geologic systems.

The Executive Committee of the Eleventh Congress, held in Sweden, compiled and published a comprehensive report on the Iron Ore Resources of the World. The present Executive has undertaken the preparation of a similar monograph on the Coal Resources of the World. The co-operation of all the principal countries of the world has been invited and this invitation has met with a cordial response.

An extensive series of excursions is being arranged to illustrate the typical geology and mineral resources of Canada. These excursions will take place during August and September and will extend from Cape Breton and Halifax on the Altantic to Prince Rupert and Victoria on the Pacific, and from Niagara Falls on the Southern Boundary to Dawson City near the Arctic Circle.

The value of the annual mineral output of Canada has steadily increased year by year for the last thirty years and it is now over one hundred million dollars. Considering, however, the known resources and the enormous territory whose resources are unknown, this output is small, and Canada needs more men and more money for prospecting, development and operation.

Since the first meeting of the Congress in Paris in 1878, meetings have been held in Italy, Germany, England, the United States of America, Switzerland, Russia, Austria, Mexico and Sweden. Meetings of various geological and other scientific societies have been held in Canada in the past, and this is the first occasion on which the International Geological Congress is to meet here.

CROPS AND CULTIVATION

AGRICULTURAL METEOROLOGY

1266 – **Methods for the Study of Agricultural Meteorology.**

ASKINAZY, V. O. Parallelnekh Nabliudeniakh. S. Peterburg, 1912.

LOSKE, E. G. and OBSOR, RABOT. Po Selskokhosiaistvennoi Meteorologhii i po Voprosam s neiu Sviassannim. *Trudi Selskokhosiaistvennoi Meteorologhii* (Work of Agricultural Meteorology), Vypusk VII, pp. 1-94. S.Peterburg, 1912.

In grouping the values of a meteoriological factor with a view to stating the average for a given period or time, for instance, yearly, daily, etc., it is evident that these determinations must be based on the monthly means (fractions of the year) and on the hourly values (fractions of the day). In either case time is the sole term of reference which is naturally constant and immutable. When however it is desired to study the effect of meteorological factors, not in relation to time, but as a function of mutable beings or things, their action varies according to the various attitudes and situations of the being or thing at the moment when considered. Hence the necessity of conducting on a parallel footing meteorological and morpholo-physiological observations, because the organisms undergoing transformation and development react differently, at the various periods of their growth, to uniform and constant factors.

This applies to agricultural weather investigations. Inasmuch as from germination until maturity each plant is subject to gradual modifications, there are certain moments when a special activity with intensified growth and the appearance of new organs, or a temporary suspension of such growth, divides the entire vegetative period into intervals (states), in each of which the meteoro-phenological ratio is constant. These are the so-called phases of development, which express characteristic moments in the life of the plant and are accompanied by more or less substantial modifications of its habit. Again, there are cases in which, although perfectly distinct phases exist in regard to meteorological relations, it is not possible to select a morphological character which avails to determine them; this is what occurs in biennial plants, in which a long period of repose prevails during the winter. In the autumn growth (from the appearance of the young plants until the disappearance of the snow) and in the spring growth (from the disappearance of the snow until the formation of ears) there is no character or condition which is constant and uniform, and on the basis of which the spring and autumn periods of growth could be subdivided into phases. It has therefore been agreed to distinguish two periods *a*) of feeble and *b*) of strong growth. Thus in autumn we have the stage of strong growth when the seedling, which has lately germinated, like all young plants, grows rapidly. At this stage the plant is particularly exacting (need for abundant nutrition) and sensitive, owing to the tender-

ness of the newly-formed tissues, to unfavourable conditions of environment (low temperatures and repeated colds).

Professor P. S. Brounoff, on forms accurately prepared for recording agricultural weather observations in suitable stations, distinguishes the following periods for winter and spring cereals.

For winter cereals (oats, wheat, rye, etc.).

Period I : from the day of sowing until the appearance of the seedlings.

Period II : from the day of appearance of the seedlings until the day on which snow remains as a permanent covering on the plot.

Period III : from the day on which snow remains as a permanent covering on the plot until the moment of melting of the snow.

Period IV : from the melting of the snow until the moment of earing, when the ear of the panicle emerges from the leaf sheath.

Period V : from the moment of earing until the beginning of milky ripeness ; the field still green.

Period VI : from the day of milky ripeness until the time of complete ripeness.

For spring cereals :

Period I : from the day of sowing until the appearance of the seedlings.

Period II : from the appearance of the seedlings until the moment of earing.

Period III : from the day of appearance of the phases of earing until the appearance of yellow (cheesy) ripeness, the stage in which the caryopses are yellow, as soft as wax and are easily crushed between the fingers.

To make clear the action exercised by weather factors on the life of the plant is one of the most interesting problems of applied meteorology, which, as stated above, demands the method of parallel observations. The facts of vegetable life are so intimately connected, either direct or through the soil, with atmospheric changes, that, in view of the relative simplicity of phyto-phenological observations, the method of simultaneous determinations has received a well conceived application in the botanical world. These observations are not only of importance as regards bringing out the relation between the growth of the plant and the behaviour of meteorological factors, but occasionally they allow of deductions which go to explain problems otherwise insoluble in the department of botany and meteorology. As far back as the middle of the last century Simony in the University of Vienna insisted on the necessity for parallel observations in botany and meteorology in order to see whether for instance any relation existed between the behaviour of the seasons and the growth of the dense and loose tissues in the rings of wood, and in order to be able, if need be, to infer what are, in a good climate, the conditions of flowering, or *vice versa* to ascertain from the structure of the plants what must be the climate in a region meteorologically unexplored, or what it was at a geo-

logically remote epoch. Similar conceptions likewise guided Keppen in his classification of climates based on two principles: the meteorological factor and flower groupings. In the method for conducting phenological researches Drude shows that the value of the duration of a phase of vegetation, which naturally varies according to altitude and latitude, may at times be a more exact index of the nature of the climate than the particulars of the mean temperature. Professor Ihne calculated the beginning of the spring season (real season) on the basis of the flowering time of different plants (13 of the most widespread fruit trees and shrubs) in various localities of the Duchy of Hesse and included in a single agrarian zone all the localities in which flowering takes place within an interval not exceeding four days. The Duchy of Hesse was thus subdivided into eight zones: in the least favoured zone spring appears between the 19th and 22nd of May; in the most favoured between the 21st and 24th of April. Although the said zones are only delimitated on the basis of purely phenological data, they likewise correspond perfectly to the given meteorological values, above all the temperature of the air.

In the "Second natural calendar of St. Petersburg" (Vtoroi Dnevnik Peterburgskoi Prirodi) by Kaigorodov, in the ten years 1898-1907, the two springs of 1904 and 1906 are distinguished by their opposite characters: the former is extremely long (103 days); the latter very short (71 days). The contrast is also evident if we only consider the third period of the spring (that is the period from the budding of sloes to the phase of flowering of lilacs), a period which in 1904 lasted 58 days (20 more than the average) and in 1906 20 days (8 less than the average). As this portion of the spring likewise comprises the flowering phase for fruit trees generally and the earing phase for cereals, it is logical to suppose that this discordance of character between the two seasons is likewise reflected in the duration of the respective phases for the various crops.

Let us consider in point of fact:

1. The duration of period III (from the budding of sloes to the flowering of lilacs).

2. The epoch of flowering of various fruits.

3. The duration of period IV of vegetation of winter cereals (*i. e.* from the disappearance of snow until earing).

4. The mean value of meteorological factors, for instance the temperature of the air.

Let us illustrate this by an example supplied by the forestry school of Parfin where there is an agricultural weather station with a small field attached, part of which was put under rye in 1904, under oats in 1905 and once more under rye in 1906. Some phenological observations were also made, especially for pine among forest trees, and for some fruit trees.

The results are as follows:

1. In 1904 sloe budded on April 15 and lilacs began to flower on June 11. The duration of period III of spring is therefore 58 days. In 1906 sloe budded on April 17 and lilacs flowered on May 6. The period therefore had a duration of 20 days. Difference 38 days.

2. In 1904 alder flowered on April 11 and pine on June 14. In 1906 alder flowered on April 13 and pine on May 11. The period was thus 56 and 29 days respectively, with a difference of 36 days.

3. Finally period IV of growth of rye in 1904 covered 75 days (from March 26 to June 8), and in 1906 36 days (from April 13 to May 18), with a difference of 39 days.

In the following table the above relations are brought out still more clearly.

Phenological periods	1904		1906		The third period in 1906 was shorter by
	Dates	Duration	Dates	Duration	
According to Kaigorodov's system /	15. IV -11. VI	58	17.IV- 6. V	20	65 %
According to Ihne's system . . .	11. IV -14. VI	65	13.IV-11. V	29	55 %
According to the phases of development of winter rye	26.III - 8.VI	75	13. IV-18. V	36	52 %

Although the date of disappearance of the snow is, as will readily be understood, of very relative value, the results obtained agree with our assertion. Let us now see what is in particular the behaviour of meteorological factors in the two springs, a behaviour measured with such accuracy by the vegetable world, so as to enable meteorological conclusions to be drawn from considerations of a biological character. The mean temperature during the three months March to May 1904 was +2.9° C. (37.6° F.), and in 1906 + 5.1° C. (41.2° F.); if however we consider only the interval April to May, the contrast is still more conspicuous, as we have 6.8° C. (44.2° F.) and 12.0° C. (53.6° F.) respectively. Moreover if, as the system of parallel observations requires, we limit the recording of temperatures to the corresponding vegetative periods, adopting the averages for

1904, April 7-June 11 = 66 days
1906, April 15-May 12 = 28 days

we have:

1904, 8.0° C. (46.4° F.)
1906, 14.5° C. (58.1° F.).

As will be seen, the contrast between the two seasons in regard to the meteorological factor " temperature of the air " is very conspicuous indeed. But notwithstanding these noteworthy differences, the sum total of the temperatures (in degrees) of the years 1904 and 1906 is practically the same, their distribution being different.

This circumstance once more renders evident the inaccuracy of statistical comparisons drawn from the year-books of ministries and weather reports, and the necessity of conducting on a parallel footing meteorological and phenological observations, when it is desired to establish the relation between successful crops and the course of the weather.

1267 - **Distribution of the Temperature at Various Heights from the Ground during Frosts.**

KOSLOVSKII, G. Raspolojenie Temperaturi v Raslicnikh Sloiakh Vosdukha pri Utrennikakh. - *Khosiaistvo* (The Farm), VII God, No. 25, pp. 841-842. Kiev, 28 Junia 1912.

In the anticipation of heavy frosts in the night of April 26-27 in the district of Orghiev in Bessarabia, the Author made the necessary arrangements for studying the course of the temperature at various heights during the occurrence of the phenomenon. A first thermometer was placed on the surface of the ground and six others higher and higher at equal intervals of 28 inches, the highest being thus at 14 ft.; the instruments were fastened to wooden poles. The records were made in the evening and night at the following hours: 1) at 9 p. m.; 2) at 11; 3) at 11.30; 4) at 4.30 a. m.; 5) at 5 (sunrise); 6) after sunrise, at 5.30. The figures read off are given in the following table.

Temperatures in deg. C.

Height of thermometers	Hours of readings					
	9 p. m.	11 p. m.	11.30 p. m.	4.30 a. m.	5 a. m.	5.30 a. m.
On ground . . .	+ 1.0	— 4.0	— 4.0	— 3.5	— 3.0	— 2.25
2 ft. 4 in. . . .	0.0	— 4.5	— 5.75	— 3.5	— 2.75	— 2.1
4 ft. 8 in.	+ 1.3	— 2.1	— 1.6	— 2.1	— 1.6	— 1.8
7 ft.	+ 1.1	— 1.4	— 1.3	— 1.9	— 1.4	— 1.7
9 ft. 4 in	+ 1.2	— 1.0	— 1.2	— 1.5	— 1.2	— 1.2
11 ft 8 in.	+ 1.4	— 0.8	— 0.7	— 1.0	— 0.7	— 0.7
14 ft	+ 2.25	— 0.5	— 0.5	— 3.75(?)	— 2.75(?)	— 0.6

The lowest temperature was observed at a height of 2 ft. 4 in. At 4 ft. 8 in. it is already almost double, and at 14 ft. the lowering of temperature below freezing-point is almost nil. For this reason trees in flower suffered very little, less than shrubs; the leaves of the vine were scorched precisely at a height between 2 ft. 4 in. and 3 ft. 3 in.

1268 - **The Soils of Macedonia and Epirus and their Cultural Value.**

1* ROLLEY, P. and DE VISME, M. La Macédoine et l'Epire (Vilayets de Monastir et de Janina). Etude de Géographie physique et d'Agrologie. (Etude Agrologique). — *Annales de l'Institut National Agronomique*, 2e Série, Tome X, Fasc. 2e, pp. 375-447 + 24 figs. + 1 carte ; Tome XI, Fasc. 1er, pp. 1-75 (1-12) + figs 25-42. Paris, 1911-1912.

2* RAMANN, E. Bodenkunde, Übersicht der Bodenarten Europas, Dritte Aufl., 6., III, pp. 560-604 + figs. 57-63. Berlin, 1911.

It is known that, except in the arid zone (S. Russia, Roumania, Hungary and the Iberian Peninsula) yellow and red soils are more or less characteristic of the Mediterranean regions. An investigation made by MM. Rolley and de Visme gives a more exact idea of agronomical characteristics and the economical value of a little-known Mediterranean region of considerable importance from the agrological point of view, as is about to be shown.

MM. Rolley and de Visme have been entrusted by the Minister of Public Works of the Ottoman Empire with a mission of enquiry respecting the hydraulic agricultural works and the land improvements to be carried out in the vilayets of Monastir (Macedonia) and Janina (Epirus). The following data can be obtained from the first published part of the report furnished to the minister.

Nearly all the geological systems are present and crop out in a more or less complete manner in the district studied ; and they have given rise to soils of very variable quality.

Rocks in situ. — Crystalline rocks occupy little space in Macedonia, while metamorphic rocks predominate. The latter have given rise by decomposition to gravelly barren sands, which are easily carried down to the bottom of the valleys. The brows of the hills are as a rule denuded, or covered with a dwarf vegetation ; the " talwegs " support meadows. All these soils are deficient in lime and phosphoric acid ; they are of very little interest from the agricultural standpoint. The primary schists and phyllads cover a large extent of undulating hills, north of the vilayet of Monastir; they weather when exposed and give rise to cold clay soils poor in phosphoric acid, but rich in potash ; the presence of lime gives them moderate fertility. They are under pasture or wood, with some cereal crops near dwellings. The continual deforestation has disastrous effects upon these friable and sliding soils.

The limestones, which cover a large portion of Epirus, are at the surface much fissured and decomposed. The clay derived from them is carried away by the streams to the bottons of the valleys, or of the intermediate hollows, forming the " terra rossa " to which cultivation (cereals, vines, olives, lemons) is practically confined. The flysch, which consists of a mixture of grit and schistose sediments, covers large areas. The soils resulting from its decomposition are of very varying quality (siliceous, ar-

Samples.	Physical Analysis.										Chemical Analysis.				
	Per 1000 parts of														
	dry soil		fine soil												
	pebbles	fine soil	coarse sand				fine sand			clay	humus	nitrogen	phosph. acid	potash	lime as carbonate
			total	silic.	calc.	organic matter.	total	silic.	calc.						
Deposits of the plain of Monastir, light coloured (yellow or grey) micaceous.															
a)	0	1000	483.9	476.7	3.0	4.2	422.4	414.0	8.4	65.8	3.7	0 99	3.66	8.09	16.1
b)	103	897	553.6	549.2	2.5	1.9	364.3	360.3	4.0	57.2	11.4	0.58	2.67	5.04	13.8
c)	0	1000	230.5	228.7	0.3	1.5	347.3	331.9	15.4	388.1	12.0	1.24	1.37	4.31	17.6
Alluvium of the mouth of the river Louros, light coloured.															
a)	46	954	229.8	151.0	74.6	4.2	605.0	454.1	150.9	134.9	2.7	1.52	1.38	2.99	243.3
b)	0	1000	179.6	151.2	25.5	2.9	560.9	425.8	135.1	218.5	10.8	2.04	2.75	3.34	165.7
Maize soil of the Margaretch plain.															
.	0	1000	306.9	304.0	0.1	2.8	468.6	457.5	11.1	194.7	5.7	0.82	0.47	1.33	15.5
Soil of the Delvinon plain, light coloured.															
.	180	820	240.7	237.6	0.2	2.9	531.7	517.1	14.6	189.3	14.7	2.57	0.95	1.87	14.9
Alluvium of the Valona plain, light coloured.															
a) (*marsh*) . . .	0	1000	426.9	394.8	37.3	4.8	460.2	411.1	49.1	80.9	5	1.34	1.31	2.54	89.9
b)	0	1000	539.9	476.6	54.3	9.0	262.1	176.6	85.6	157.0	2.8	1.50	0.74	2.13	147.3

gillaceous) and are nearly everywhere under cultivation (maize, barley, oats, fruit trees, vines, oak coppices).

Transported soils. — Here, as elsewhere, the alluvial soils form the agricultural zone *par excellence*. They form, in the two districts, about one fifteenth of the whole area, *i. e* nearly 1200 sq. miles. They are basins which long existed as lakes, or inundation plains and deltas. They all consist of silty deposits, generally very fine and offering exceptional advantages from a cultural standpoint. These soils are suitable for cereals and beets, being rich in fertilizing compounds, notably organic matter and phosphoric acid. At the same time, they are often flooded and are difficult of access ; only a small portion is at present cultivated.

In order to ascertain exactly the agricultural value of these alluvial plains, MM. Rolley and de Visme took samples of soils from some of them for analysis. It should be observed that these soils, which have been cultivated for centuries, have never received any kind of fertilizer and are certainly superficially very much impoverished.

The analyses are given on the apposite page.

The soils from which the three first samples were taken are impermeable; and the general very small fall, with carelessness and lack of concerted action, contribute to keeping them in a condition of insufficient drainage. Cereal and market-garden crops predominate, with raising of cattle and horses.

The alluvium of the river Louros is very fertile, and cereal crops (wheat, maize and rice) are grown upon it. The water is, however, not regulated.

The crops grown on the plain of Margaretch are : maize, wheat, rice. The fields are separated by deep ditches to carry of the water.

In the plain of Delvinon, fruit trees, olives, maize and rice are grown. There also a rational system of improvement is required.

The alluvium of the plain of Valona consists of very fertile soil, and proper exploitation, rendered possible by the formation of roads, would make this district one of the richest in Epirus. At present, cereals and shrubs are chiefly grown.

In conclusion, these soils are mostly fertile, heavy, compact, and somewhat impermeable and require systematic improvement to a greater or less extent.

1269 – **Relation of Active Potash to Pot Experiments.**

FRAPS, G. S. *The Journal of Industrial and Engineering Chemistry*, Vol. 4, No. 7, pp. 525-526. Easton, Pa., July 1912.

Pot experiments with representative Texas soils have been carried on at the Texas Agricultural Experiment Station for seven years. The plants were grown in pots containing 500 gr. of soil, application of fertiliser being made to the various pots. The crops were classified as follows: DD, very

deficient if only 50 per cent. or less of the completely fertilised crop; D, deficient, if less than 90 per cent; S, not deficient, if between 90 and 110 per cent.; T, injured by the fertiliser if over 110 per cent. The crop without potash treatment (PN) was always compared with the crop treated with potash (PNK). By the term "active potash" is meant that soluble in one-fifth normal nitric acid.

Relation of deficiency to active potash. — The 172 soils studied have been divided into groups according to their content of active potash. The following table shows the percentages of crops.

Relation of active potash to number of deficient crops.

Active potash in soil. Parts per million	Percentage deficient (DD, D)	Percentage injured (T)
0- 50	86.7	7
50-100	55.1	17
100-150	54.3	16
150-200	39.1	17
200-300	37.5	31
300-400	42.6	25
400-600	15.0	46
600-800	18.0	44

The percentage of DD and D, decreases with the quantity of active potash in the soil. The percentage of T increases with the quantity of active potash in the soil.

Relation to weight of crop. — The weight of the crop without potash treatment divided by the weight with potash treatment, expressed in percentages, shows the relative effect of the potash on the growth of the plant. The average figures for 403 crops are given in the following table:

Relative size of crop without and with potash.

Active potash in soil. Parts per million	Percentage PN/PNK
0-50	67
50-100	79
100-150	84
150-200	91
200-300	100
300-400	98
400-600	101
600-800	116

The effect of fertiliser potash on the weight of the crop decreases with the active potash in the soil. When the active potash exceeds 200 parts per million, the fertiliser potash effects no increase, on an average.

Relation to potash content of crop. — The average potash content of Indian corn, Kaffir corn and sorghum crops are given as follows :

Relation of active potash to potash content of crops.

Active potash in soil. Parts per million.	Percentage of potash. Corn.	Kaffir and sorghum.
0-50	1.38	0.78
50-100	1.70	0.93
100-150	2.29	0.89
150-200	2.55	1.45
200-300	3.65	1.68
300-400	3.53	1.72
400-600	3.83	2.44
600-800	4.31	1.79

The potash content of the crops increases with the active potash content of the soil.

Relation of active potash to total potash removed. — The average and maximum quantity of potash removed by the crop which received no potash was as follows :

Relation of active potash removed by all crops to active potash of soils.

Active potash in soil. Parts per million.	Potash removed by crops in parts per million of soil. Average.	Maximum.
0-50	29.3	53.4
50-100	37.2	143.3
100-150	51.0	176.2
150-200	80.9	249.6
200-300	120.1	434.6
300-400	156.9	354.8
400-600	119.4	295.8
600-800	206.9	380.8

The average quantity of potash removed by the crop increases with the active potash content of the soil.

Conclusions. — 1. The average percentage of crops deficient in potash decreases with the increase of active potash in the soil. — 2. The average percentage of crops injured by potash increases with the increase of active potash in the soil. — 3. The effect of fertiliser potash on the weight of the crop decreases as the active potash content of the soil increases. — 4. The percentage of potash in the crop increases as the active potash in the soil increases. 5. The total potash removed by the crop from the soil increases as the active potash in the soil increases.

1270 – **The Presence of Nitrifying Bacteria in Sand Cultures.**

SCHULOW, Iv. Nalicnosti Nitrifiziruiustcikh Bakterii v obecnekh Pescianekh Kulturakh Rastenii. — *Jurnal Opétnoi Agronomii* (Review of Experimental Agriculture), God XIII, Kniga 2, pp. 211-215. S. Peterburg, 1912.

The writer gives the results of many of his experimental researches concerning the problem of the nitrification processes taking place in sand cultures, a problem which is so far unsolved, but of which the significance is easily understood. Should no process of nitrification be ascertained, experiments could be carried out, for instance on the assimilation of ammonia by plants, without having recourse to sterilized cultures. The loss of ammonia due, during the sterilization process, to the action of the magnesium carbonate upon the ammonium sulphate of the nutritive solutions hinders the nitrifying bacteria, if present, from developing and proving their existence by giving rise to the different nitrification phenomena, which circumstance naturally makes the experimental work very difficult.

The writer placed in a thermostat (kept at a temperature of 28 to 30° C.) some burettes containing a certain quantity of sand, besides the sterile substratum (Omelian formula), and others without sand, the latter to serve as a control.

After 12 days, treatment with diphenylamine, which serves as an index of the amount of the nitrogenous compounds present, showed a slight reaction; later this became more intense, proving, at the end of about a month from the time of the commencement of the experiment, the indisputable presence of a certain amount of nitrogen oxidised to a nitrous state. The burettes were then removed from the thermostat and their contents examined.

After remaining a month in the thermostat, an enormous loss of ammonia, as much as 95.5 %, was proved both from the burettes containing sand and from those which served as a control; this loss was due to the action of the magnesium carbonate contained in the solution.

It is thus not surprising, if under such conditions, the nitrifying bacteria, undoubtedly present in the sand cultures, were unable to develop and to transform any considerable quantity of nitrogen.

PERMANENT IMPROVEMENTS. DRAINAGE AND IRRIGATION

1271 – **A Determination of the Distance apart of Field Drains based upon the Hygroscopicity of the Soil.**

BREITENBACH, R. Die Bestimmung der Drain-Entfernung auf Grund der Hygroskopizität des Bodens. — *Der Kulturtechniker*, XV Jahrgang, No. 3, pp. 177-210. Breslau, 3. Juli 1912.

In carrying out systematic drainage, the following two problems must first be solved:

1. The best depth to place the pipes.

2. The right distance to be left between the drains in order to obtain the best drainage and to avoid incurring unnecessary expense by placing them too near together.

The solution of these two problems is not always easy and, indeed, requires an exact knowledge of the physical properties of the soil; further, it is necessary to take into consideration the different strata present and the geological formation and topography of the ground.

The failure of some drainage works, especially of those carried out in heavy relatively impermeable clay, shows the uncertainty of the method hitherto employed in determining the distance. Spöttle had already observed that, if in light soils a great depth of the drains would allow of a longer distance between the latter, in heavy relatively impermeable soils, the difference between depths of 49 and 46 inches was very small. The first drains were laid at a depth of 32 to 40 inches; but very soon, the desire arose to increase this depth. In Bohemia and Württemberg, the pipes were placed at 51 inches in light soils, and 55 in. in heavy and, in the case of sugar beets, at a depth of 5 feet, or more.

Also in Switzerland, according, to recent reports, it is wished to extend the depth from 51 to 55 inches. In England, on the other hand, the following depths have been adopted recently with conspicuous success:

Very heavy soils	30	to 33 inches
Medium soils	37 ½	to 39 inches
Light soils	42	to 54 inches

In Prussia, the General Commission for Silesia has prescribed a general depth of 49 inches.

The writer quotes many other local examples and the opinions of various recent authors to show the difference of existing opinion on this subject and finally recommends, as a general rule, the following depths:

Very heavy soils	33 inches
Medium soils	43 inches
Light soils	49 inches

Going on to speak of the distance apart of the drains, he observes that the differences of opinion and the divergence are still greater. This is due to the fact that physico-mechanical analyses of the soil do not supply accurate data for the solution of the question of distance.

Kopecky's aeration capacity (Luftkapazität) is also not a more available datum. Mitscherlich has shown that it is a factor which constantly varies in the case of the same soil.

Mitscherlich, however, obtained surprising results by his method of determining the physical characteristics of a soil from the superficial area

of its components (Bodenoberfläche) — taking into account an internal area " micellare " for the organic vegetable matter ; this caused the writer to make a series of determinations in drained soils to see whether there was a relation between the absolute surface-area of the components of the soil (equivalent to the surface-area of the volume of its empty space) and the distance of the drainage pipes.

Thus, after a brief explanation of the two methods adopted by Mitscherlich for the determination of the absolute area of the ground — based upon the determination of the calories of hydration and on hygroscopicity — the writer describes his experiments, giving the results in a diagram in which the distances apart of the drains in the soils examined are the abscissae and the hygroscopicities the ordinates. Such determinations of hygroscopicity were made by means of a numerous series of drained soils varying from the lightest to the heaviest and from which those were eliminated which proved to be insufficiently drained. Since, however, the determinations could not give the average for the different distances for drainage pipes, the writer obtained the maximum and minimum limits by interpolation and deduced the averages.

These averages made a curve on the diagram, which corresponds almost exactly to that obtained by the following equation :

$$log\ w_0 - log\ w_1 = c\ (d_1 - d_0),$$

where w_0 = the hygroscopicity for the distance between the drains at the point where the drainage system begins ;
w_1 = the hygroscopicity for any other distance of drainage pipes ;
d_0 = distance of the pipes o ;
d_1 = distance of the pipes for any value $w.$;
c = a constant.

Since $d_0 = o$, we have :

$$d_1 = \frac{log\ w_0 - log\ w_1}{c}$$

$$c = \frac{log\ w_0 - log\ w_1}{d_1}$$

Having determined the arithmetical mean of the constant c it is possible by the following formula :

$$d_1 = \frac{log\ w_0 - log\ w_1}{c}$$

to establish the distance for drainage pipes for given soils, solely from their hygroscopicity, as has been done by the writer in the following table :

Distance apart of Drains		Hygroscopicity of Soil	Distance apart of Drains		Hygroscopicity of Soil
ft.	in	%	ft.	in	%
16	5	22.20	52	6	5.51
19	8	19.55	55	9	4.55
23	0	17.22	59	1	4.28
24	8	16.17	62	4	3.77
26	3	15.18	65	7	3.32
29	6	13.37	68	10	2.93
32	10	11.78	72	2	2.58
36	1	10.38	78	9	2.00
39	4	9.14	82	0	1.76
42	8	8.06	85	3	1.55
45	11	7.10	91	10	1.21
49	3	6.25	98	5	0.94

The above table does not hold good for organic soils such as peat.

1272 – A Great Work for Irrigation in Sardinia.

RAINERI, LUIGI. Una grande opera per l'irrigazione in Sardegna. *L'Italia Agricola*, Anno XLIX, No. 13, pp. 308-311 ; Piacenza, 15 luglio 1912.

A concrete scheme, studied from the technical, financial and agricultural points of view, for the creation of a great reservoir of the Tyrsus for irrigation has been completed by Signor Angelo Omodeo ; and the work about to be begun will supply water to about 125 000 acres of land. The Tyrsus dam will have a capacity of 5¼ million cubic feet and it seems that, with works which will not be very expensive, its capacity may be considerably increased. The length of the artificial lake will be 7½ miles. This reservoir is to serve not only for the supply or irrigation water but also for the production of power by a waterfall and for regulating the downflow of the waters to the plain, rendering the cultivation of the lower valley easier and less burdensome. This latter advantage has induced the Ministry of Public Works to promise its assistance in the construction of the reservoir by reason of the saving which will result to the Ministry in the fulfilment of its task of improvement of the plain. From the Tyrsus dam an energy of at least 10 000 H. P. can be obtained.

At the present time the 115 000 acres devoted to agricultural and forest production in the Campidano di Oristano are divided as follows : 70 % grazing land, 15 % under cereals, about 7 % beans and vegetables and 8% under intensive fruit-tree cultivation (vines and olives) ; a small part is wood and productive uncultivated land.

In the 21 communes of this territory the last census recorded the presence of 3889 horses and asses, 10 041 head of cattle, 68 717 sheep and 5700 goats. The cattle are always kept out, chiefly on pasture ; their food is therefore dependent on the season and the winter months from Decem-

ber to February and the summer months from July to September are particularly scarce in food. Rational irrigation should therefore be directed towards the intensive production of forage and the transition from a system based on cereal growing in combination with pasturage to another system combining irrigated fields with cereal growing, reservi g some place for pasturage and interrupting the grassland-cereal rotation by a few hoed-crops ; those who have studied the question consider that this would give excellent economic results. It is well adapted to a sparsely populated region where the use of the harvesting machine will likewise allow of maintaining some regularity in the demand for labour during the year. An approximate account of cultivation expenses would show a profit of 9 % on the capital invested on a farm adopting this system. The Tyrsus dam, by allowing the irrigation of an extensive zone, will therefore perform a noteworthy part in the economic resurrection of those regions.

1273 - **Irrigation in South Africa** (1).

MULLIE, J. 1.* Notes sur les Irrigations de la Colonie du Cap. 2.* Emploi de l'Eau en Irrigation. Expériences effectuées en Afrique du Sud. — *Bulletin Agricole du Congo Belge*, Vol. III, No. 2, pp. 257-287, and pp. 481-490. Bruxelles, juin 1912.

1.* South Africa is divided from both the meteorological and the agricultural points of view into four perfectly distinct plateaux of different altitudes separated from each other by chains of high mountains. Along the coast, in the south, comes the maritime plateau with an average height of 100 metres (330 ft.), on which the average yearly rainfall is calculted at about 1 metre (39 in.) ; the climate here is influenced by the nearness of the ocean. Then, at a height of 300 to 400 m. (1000 to 1300 ft.), comes the arid zone of the Little Karroo, where rain is rare, not exceeding 25 cm. (10 in.) yearly. The great plain of the Central Karroo is still higher, 600 to 700 m. (2000 to 2300 ft.) ; it is essentially a pastoral region, where the occasional winter rains are just enough to support a slight vegetation for the grazing of sheep and goats. Finally, beyond the Nieuwveld mountains, is the Great Karroo, which is prolonged into the plains of the Orange River Colony and the Transvaal.

This study on irrigation in Cape Colony deals only with the high plateau of the Little Karroo, the exceedingly fertile and rich lands of which really only require a plentiful supply of water.

According to Mr. C. E. Kauthack, the director of the Irrigation Department of the South African Union, the costs of the fundamental work for improvement by irrigation must be reckoned at an average of £10 per acre for Cape Colony, while 30s. per acre is enough for the preparation

(1) See *B.* April 1912, No. 626. (*Ed.*).

of the land. If these averages are compared with those of other countries where irrigation is conducted on a far vaster scale, as for instance in India and America, it is observed that the cost of irrigation work is higher in South Africa, and the causes may be specially sought in the greater cost of native labour and the high rates of transport. The more general use of excavating machinery would greatly reduce the expense.

At Robertson, land worth 17*s.* per acre fetches, after the work of irrigation is completed, a minimum of £ 50. In the district of Oudtshoorn, where land is sold at 8*d.* to 1*s.* 4*d.* per acre, and where a pastoral population of 1000 to 3000 inhabitants was scattered through desert valleys, a few rudimentary changes have sufficed to transform waste places into rich lucerne pastures. Prices have risen to £ 130 and £ 160 per acre ; a population of about 60 000 inhabitants now occupies this district, which is regarded as the richest in South Africa. As a result, speculation has sprung up, and forms a serious obstacle to the rational progress of irrigation.

It may be reckoned that in South Africa the cost of upkeep and repair of the works which carry the water to the land by gravitation, is 5*s.* to 17*s.* per acre irrigated per year, which corresponds to 12 to 20 % of the value of the crop. When the extent of the latter permits, irrigation is carried out by pumps, which require a relatively small investment of capital, but the operation of which involves an expense of £ 2 to £ 3 per acre irrigated. Notable endeavours are being made to reduce these expenses to the minimum. The Cape Government, at its various agricultural experiment stations, demonstrates by experiments the best methods of utilising the water on scientific and economical lines, which ensuure the best yield both in quality and quantity.

At the present time South African farmers are specially engaged in ostrich rearing and the remunerative feather industry, in which transport is easy and inexpensive ; for other products exportation is made difficult by the enormous distances, the slowness of transport, and likewise, for perishable commodities, by the unfavourable temperature. Ostrich rearing has substantially contributed to the irrigation of those regions.

For irrigation to be carried to the desirable proportions the population must become denser, and thus form a natural market of consumption on the spot for the produce of the soil ; communications also must be improved and railway freights reduced ; and the produce should be supplied in better quality and at a lower cost price. Until these conditions are fulfilled it will be best to refrain from great irrigation works and pay attention to the development of small holdings.

The water available for irrigation is exceedingly limited in South Africa. Lately great progress has been made in the canalisation and utilisation of the springs at the foot of the mountains dividing the Little from the Great Karroo. The irrigation works of the Nuy River, which

include a steel conduit 3 miles long and a channel of 15 miles, were finished in 1907; they allowed of the irrigation of 6250 acres and cost £16 000. The enlargement of the channel of the Doorn River near Worcester was finished last year and the improvement of its course allowed of extending irrigation to an area of 2400 acres.

The torrential character of those rivers makes irrigation intermittent and compels farmers to wait for the flood time in order to feed the channels; many motor-driven pumps pour masses of water on to the land or into vast reservoirs. The channels have been arranged in co-operation with the owners of land along the banks. Many schemes for reservoirs are in process of study and some of them have already been carried into effect in the South-East district.

Artesian wells, though expensive, find favour with South African farmers because a single well, which allows of cultivating an acre or so of lucerne, allows live-stock to be kept over extensive areas of land, obviating all fear of the herds perishing in a year of drought.

The de-forestation of the plains of South Africa has resulted in a more rapid descent of the waters towards the rivers and the sea; ravines have formed and have become the beds of torrents. The Government of South Africa has invited farmers to embank these waters and keep them in reservoirs. Shallow reservoirs of large area receive the muddy waters which come down from the surrounding hills. The deposits of highly fertile mud at the bottom of these reservoirs are cultivated during the dry season, when the water collected has been used for irrigating the pastures. These reservoirs are called "Zaaidammen" (Sowing dams).

Nothing is neglected in this country to turn to account the scanty rain; the Government contributes by advice and financial assistance to the development of irrigation works, and the new laws applied in 1906 with regard to loans granted by the State for this pupose, have given a powerful impetus to agricultural progress.

A special Irrigation Office has been created and placed under the direction of Mr. C. E. Kauthack. The colony has for irrigation purposes been divided into three districts. Mr. Kauthack calculates that from 1907 to 1909 100 000 acres were irrigated at a total expense of £ 550 000, and that the net increased value of the land thus brought under cultivation, after deducting the expenses for the work, must be estimated at about £ 1 860 000. During these three years, the expenses incurred by the Irrigation office in works of investigation, loans etc., amounted to £ 36 000. The following are the practical results obtained:

	Number	Estimated cost: £	Area acres
Reservoirs :			
Built for private irrigation by the advice of the Office . . .	26	107 800	39 606
Built with loans granted by the Government	51	38 536	6 155
Total . . .	77	146 335	45 761
Canals :			
By private initiative	68	63 119	26 937
By Government loans	29	281 422	42 472
Total . . .	97	344 541	69 409
Pumps :			
By private initiative	33	21 332	3 605
By Government loans	30	19 698	2 656
Total . . .	63	41 030	6 261
Zaai dams :			
By private initiative	—	—	—
By Government loans	5	2 530	635
Total . . .	5	2 530	635

The Irrigation Office has organised an Investigation Department whose duty it is to examine into the resources of the country and definitely determine the possibilities of the realisation of great schemes. The engineer of the department receives precise instructions from the Office and a detailed sheet of questions, on which he must enter the information collected. With these data, the district engineer can prepare a preliminary scheme, which, being submitted for examination to those interested, is converted by the latter into a definitive scheme. The Irrigation Office has likewise organised a meteorological department and a hydrographical service, and finally, during the last few years, an Enquiry Office in charge of which are the district engineers and the agents throughout the country.

The principal works carried out direct by the State were those of Van Wyck's Vlei, Douglas, Brandvlei, and Rooiberg near Kendart. The economic results of these undertakings were negative; in South Africa, where the works do not directly interest a large number of persons, the State must confine itself to subsidising them. This principle of State-aided irrigation, accepted in the irrigation law of 1877, was only adopted outright by the Government after the new bill in 1906. Under the present system, when the preliminary scheme prepared by the Irrigation Office meets with the approval of the owners of at least two thirds of the lands

Experiments on irrigation of Barley, 1909-1910.

	Plot No.	Water supplied: inches	Preliminary irrigation: inches	Separate irrigations (inches) 1st	2nd	3rd	4th	Total rainfall between seedtime and harvest: inches	Total water received including rain: inches	Weight of crop in lbs. On the field	Grain
Two irrigations	1	8	4	4	4	—	—	4 ½	12 ½	1279	464
	2	10	4	5	5	—	—	4 ½	14 ½	775	252
	3	10	4	4	6	—	—	4 ½	14 ½	1048	438
	4	12	4	6	6	—	—	4 ½	16 ½	1091	425
Three irrigations	5	10	4	4	3	3	—	4 ½	14 ½	1050	380
	6	13 ½	4	4 ½	4 ½	4 ½	—	4 ½	18	1282	521
	7	18	4	6	6	6	—	4 ½	22 ½	1121	380
	8	12	4	4	4	4	—	4 ½	16 ½	1134	366
	9	12	4	6	3	3	—	4 ½	13 ½	1279	417
Four irrigations	10	13 ½	4	4	3	3	3 ½	4 ½	18	1303	566
	11	18	4	4 ½	4 ½	4 ½	4 ½	4 ½	22 ½	732	239
	12	24	4	6	6	6	6	4 ½	28 ½	713	209

Dates of irrigations. Plots 1-4: first Sept. 18; second Oct. 18.
Plots 5-12: first July 6; second Sept. 18; third Oct. 18; fourth Oct. 27.

Date of harvest. All plots: Nov. 10.

proposed to be irrigated, the Government decrees that the zone is an irrigation district and the landowners appoint a committee which elects its own chairman. The committee contracts loans and levies taxes for the execution of the works ; it receives funds from the Government on loan at a minimum interest and settles the questions which so frequently arise in South Africa as to the individual rights of the farmers, which rights form a great impediment to the development of private irrigation undertakings.

2. * In a region like South Africa, where the variety of soils is exceedingly great and the rainfall and temperature both vary from place to place, it is impossible to establish an absolute and general rule to settle the complex question of good utilisation of the water. The efflorescence of salt on many stretches of land in Cape Colony makes all cultivation impossible unless this drawback is remedied hy artificial drainage and by maintaining on the surface of the soil a thick mulch. This was one of the causes of the failure of the irrigation at Van Wyck's Vlei. But the principal source of error in the use of irrigation water is excess. In 1906 carefully controlled experiments were entered upon at the Robertson agricultural station and were continued from 1908 in other important centres of the Colony where the conditions of climate and soil were different. The experiments were aimed at ascertaining the effects of a deficient, sufficient and excessive irrigation. The table of the results obtained in 1909-1910 for barley is given on the opposite page. From this it is clear that not only does the quantity of water employed affect the crop, but the yield depends on another factor, and that is the mode of distribution of that quantity of water. Thus, plots 4, 8 and 9 gave a different yield according as the same 12 inches of water were supplied in two or in three instalments. The largest return was obtained on plot 10 with 13 ½ in. of water in four instalemnts ; the next return was that on plot 6 with 13 ½ in in three instalments. For cereals the yield only varies in slight proportions for a total quantity of water of 16 to 20 inches, provided it is supplied judiciously. This result was corroborated by subsequent experiments, and it may be said that in the Little Karroo, where water is hard to find and fields are extensive, the best results will be obtained by supplying a total of 16 in., while if water is abundant and the fields small 20 in. will be better.

Comparing these figures with those now in use in the South African colonies, it is noted that a tendency prevails to give an excessive quantity of water to the cereals, which is doubly harmful, inasmuch as it tends to a reduced value of the crop and an increased cost price.

Lucerne cultivated as summer forage gives the best results in Cape Colony in light soils with three irrigations for two crops, and in the ordinary shallow soils of the Karroo, with one irrigation per crop, reckoning each irrigation on the basis of 4 inches.

Irrigation by ditches or infiltration is well adapted for vineyards and orchards, and permits of the greatest economy of water.

Potatoes are the only vegetable whose yield increases proportionnally to the increase of the quantity of water supplied.

1274 – **Irrigation in Peru.**

SUTTON C. H. in *Peru To-Day*, Vol. IV, No. 1, pp. 32-36. Lima, April 1912.

The Andes form a high plateau-like divide at a general altitude of 14 000 feet above sea level, and at a distance of about 75 miles from the Pacific Coast. Rains that fall on the East of the Divide find their way into the Atlantic Ocean through the Amazon and its tributaries ; the rainfall of the West slope of the divide feeds numerous rivers of the Pacific Coast. The area of the Amazon basin, in the territory of Peru, is about 325 000 square miles. The various river-basins of the Pacific Coast sum to a total of about 115 000 square miles.

Upon the Atlantic slope of the Andes the rainfall varies from 3 to 5 feet on the summit of the Transcontinental Divide to 12 and 15 feet in the interior. The tributaries of the Amazon are navigable for considerable distances. Forests of great value cover the entire eastern part of Peru and the rubber tree is a natural growth, both upon uplands and lowlands. From the few square miles of the approximately 200 000 square miles adapted to the production of rubber in this region, Peru exports annually 3 000 tons of that product, valued at approximately $ 2 500 000. (£ 513 700)

On the Pacific Coast the rainfall varies from a maximum of from 3 to 5 feet on the summit of the Andes to less than 2 inches at sea level on the Pacific. The rivers of this region flow in very deep canyons, and frequently at a distance of thirty miles from the coast they emerge upon a plain of relatively gentle slope.

The Coastal Plain is 1 400 miles long. In some places it reaches a width of 40 miles ; in others its width is reduced to nothing, where the plain proper lies below sea level. The Northern part of the plain (from Pisco to Ecuador) is terminated on its Western edge by a low escarpment, from 10 to 100 feet in height. From this escarpment the plain slopes gradually up to the base of the Andean Plateau. The Southern part of the plain is modified by a range of hills running parallel to the sea, and consists largely of volcanic ashes.

These valley lands are the only ones upon which agriculture is practised upon any considerable scale. In many valleys, owing to the imperfect development of irrigation work, thousands of acres of good soil are uncultivated. The total area of the coastal plain excluding the heights that interrupt it, is approximately 25 000 square miles. One thousand square miles are actually under cultivation, and about one thousand more have been reported irrigable.

On the coast of Peru the season of minimum flow occurs in the early spring of the southern hemisphere (September or October), and while on some streams a temporary increase of flow occurs in October, the floods do not arrive till the summer, continuing into the autumn, March and April.

Where the regulation of flow is required, it is for the young plants. In the season of crop maturity and some time before there is more than enough water for all needs.

Corn and beans can be planted at any season in Peru.

To-day, however, there is a relatively limited market for these products, and the greater part of the lands must be devoted to the growth of crops for export to foreign markets. Such crops are sugar and cotton, and the climate of the coast of Peru, where there is never any frost, is especially suitable for the production of these crops. While the growing season of cotton is 6 months, and to obtain its maximum development, cotton requires irrigation in spring as well as in summer, it is grown in some localities with irrigation only in summer. The practice is as follows : The ground being well saturated in March or April, planting takes place in June. Careful cultivation of the surface is carried on and the plants endure until January with no irrigation. In January the summer floods supply abundant irrigation, and the crops come to maturity in March or before, giving from 250 to 500 lbs. of ginned cotton per acre. Even where there is a perennial stream flow, very small quantities of water are used in the spring: one-eighth litre per second per hectare against one litre per second per hectare (one second foot per 70 acres) in summer. Where water is available in the spring, the average production of cotton of the American Upland variety is in excess of 500 lbs. of ginned fibre per acre, and the average for the whole of Peru is 484 lbs. per acre from all varieties.

Sugar cane does not at present produce in Peru as great a crop per acre as it does in Hawaii.

While poor milling conditions and a low temperature during the winter (sometimes 40° F.) are probably a part of the cause for this, the scarcity of water during the spring months is also an important factor. Where a fair supply of water in the spring is available crops as great as those grown in Hawaii have been produced. In Hawaii, where a rate of one second foot per 70 acres obtains during the year, they have a production of 14 000 lbs. of sugar per acre. In Peru with one-eighth of that amount of water, during nearly one half of the growing season, a production of 9 000 lbs. is obtained. The sugar crops mature in Peru in from 18 to 22 months.

The cost of production of cotton in Peru is about $ 0.07 (3.45*d.*) per lb. The cost of production of sugar placed on board in the ports of the Peruvian coast is $ 0.015 (0.735*d.*) per lb.

The price of sugar and cotton land actually producing to-day, varies in different localities. Such lands have recently been sold, with water

rights, for $ 70 (£ 14-7s. 8*d.*) per acre. New lands can be placed in the same productive condition at the same cost of $ 70 per acre.

Fruit-growing, even considering some of the large vineyards near the central part of the coast, is yet a small industry. Yet the fact that all tropical fruits mature in Peru at a time when the season in the northern hemisphere is largely unproductive suggests what this field may become.

The present time from New York to the central coast of Peru is only fourteen days by steamers making fourteen knots per hour, and this time will be very considerably reduced by the opening of the Panama canal.

In Peru an irrigation service exists for the collection of data of general value to those who may wish to know conditions, and for the design of definite projects that have been investigated and reported upon by the government service.

1275 – **Redivision of Land and Drainage Work at Bretigny-sur-Morrens.**

DISERENS, E. Remaniement parcellaire et drainage à Bretigny-sur-Morrens. *La Terre Vaudoise*, 4ème Année, No. 25, pp. 245-248. Lausanne, 22 juin 1912.

The work of draining and redividing the land at Bretigny-sur-Morrens is the first instance of the kind in the Canton of Vaud without there having been any renewal of the land survey of the general territory in the commune. The question first and foremost was to drain an area of 110 acres lying close to the village. To facilitate the development of the land after drainage and ensure rapid recovery of the sums expended for the work, the construction of a regular system of access roads became indispensable. The laying down of a system of roads however necessarily involved the redivision of the area into fields.

The total length of the roads laid down is 4330 yards, being about 40 yards per acre, in consequence of the rather large number of land owners.

The value of the land was estimated by a classifying commission, when the undertaking was entered upon, according to the principles laid down in the law of 1907, taking account of the drainage to be effected. The land was divided into 16 classes, the prices ranging from 1½*d.* to 6*d.* per sq. yard. The ground value according to this assessment averages £55 15s. per acre.

The land-owners share in the construction of the roads proportionally to the value of the land owned by them.

In planning the division of the fields allowance was made for the situation and area of the old fields in allocating the new ones.

The number of old fields was 68 belonging to 24 owners. The new division comprises 54 fields, of which 7 belong to the commune.

The degree of grouping is the quotient of the effective reduction divided by the maximum possible reduction of the fields; it is here 46.5 %, while it reaches 75 % in other cases. The improvement realised as regards

the easy working of the lands is very considerable ; the fields have their longer sides parallel and the headlands are at the ends. The whole of the work of cultivation is facilitated.

The costs of redivision amount to £1 12*s.* per acre, and the roads cost £4 16*s.* per acre, making a total of £6 8*s.* for reparcelling.

The systematic drainage of the land comprised the digging of 22 000 yards of trenches, including the canalisation of the existing streamlet. The estimate for the work amounted to £1 190, and the actual cost was £921, *i. e.* £8 16*s.* 6*d.* per acre. The work proper involved an average expense of 6 3/4 *d.* per yard run, materials and carting 2 3/4 *d.*, sundry expenses 1 1/4*d.*, which makes 10 3/4 *d.* as the cost price per yard of drain, dug to an average depth of 4 ft. 10 in. The work cost the landowners £4 8*s.* 4*d.* per acre for drainage alone and £5 14*s.* for all the work. The work, begun in November 1909, was pushed ahead briskly by the contractor, so that the landowners entered into possession of their new fields in March 1911.

The rent of communal lands after the operation enables the returns of the undertaking to be appreciated : it rose from 6*s.* 6*d.* per acre to £2 15*s.* per acre, that is an increase corresponding to 15.7 % of the total sum (£15 5*s.*) involved in the enterprise.

The land survey assessment for registering the new distribution and condition of property, will be increased by the value of the work carried out. Thus the Commune and the State will, by taxation, operate a slow and easy recovery of the subsidies granted in favour of the enterprise by the Land Improvements Office of Canton Vaud.

1276 – The Cost of Agricultural Improvements in Egypt (1).

MÉDAWAR, WADY. Notes sur les améliorations foncières en Egypte. - *Bulletin de l'Union des Agriculteurs d'Egypte*, 10ème Année, No. 86, pp. 110-118. Le Caire, Mai 1912.

The following is a list of the works and of the accounts which may be comprised in Egypt under the heading of agricultural improvements. The figures given are per acre :

1. Division of the land into lots and setting out the chief roads or sections of the estates as a preliminary to the programme of further work : 20 to 30*s.* per acre.

2. Breaking up uncultivated land by means of steam or ox ploughs after cutting down shrubs and burning the bush : £ 1 10*s.* to £ 2 and sometimes, though rarely, even £ 4.

(1) Extract from a report of the writer on the improvements carried out by the Société anonyme agricole et industrielle d'Egypte in its properties during the last years and on their cost. (*Author's note*).

3. Levelling the surface with the levelling machine worked by steam or by oxen or by means of Decauville waggons drawn by mules or pushed by the men, the work being finished sometimes by flooding the land and dragging heavy planks drawn by strong teams over the submerged soil. The cost of this work is very variable, from £ 3 to £ 4 and sometimes £ 8 to £ 9 12*s*. Very undulating sand surfaces and the filling up of very low-lying lots may cost as much as £ 14 10*s*. to £19 5*s*., and in some rare instances £ 24 or £ 30 per acre.

4. Cutting of canals, consisting in the excavation proper done with spades, hoes, by hand or with baskets. Under this head syphons, culverts, small bridges, etc., are included. These canals often complete the work of parcelling the land in lots. The cutting of irrigation canals costs generally 20 to 30*s*. per acre, everything included. Drainage canals are often omitted when the ground does not require them and is not liable to infiltrations. According to the level and degree of salt content of the ground the cost of canals varies between £ 1 and £ 2 10*s*. per acre.

5. Irrigation or drainage pumping stations, which may be either simple water wheels driven by oxen and costing from £ 24 to £32, or more expensive plant up to the powerful machines worth £ 3000 to £ 4000, with all intermediate classes; the cost is generally about 19*s*. to 38*s* per acre.

6. Removal of salt: this consists in freeing the soil from salts, principally sodium chloride, by a system of washing and under-draining. Warping does not remove anything and consists principally in bringing Nile mud onto the land; in this case surface-drainage is used. Washing-out salt can generally only take place from late autumn to the middle of spring. It costs about 8*s*. to 10*s*. per acre for the season, not reckoning the use of any pumping-apparatus required. Warping is carried out in flood-time and costs rather less.

7. Improvement by crops: this is intended either to continue the work of salt-removal (rice), or to enrich the land (clover). Certain alkali-land can only be improved by a further treatment of applications of gypsum or soil. After vigorous washing-out of salt the improving crops may give a yield equal to their cost, but the first crop frequently shows a deficit of some 20*s*. This deficit, to some extent reduced however, may be repeated for each subsequent crop till the land is in good condition. Improvements by gypsum or earth may cost respectively 20 to 30 *s*. or £6 to £10 according to the amounts applied.

8. Buildings and purchase of live-stock and implements: houses, barns, sheds, oxen, mules, riding-animals, Decauville rail-road, ploughs, levellers, etc. The most appropriate system of settling requires in Egypt one labourer's cottage for every 100 to 125 acres under crops. There are some compartively dry districts in which buildings of sun-baked clay will

do, but in the Lower Delta burnt bricks have generally to be used. For this reason the cost per acre may be as low as 20 *s.* (including houses for the hands, barns, etc.), or may reach £3 to £4. The laying-down of lines for the Decauville trucks costs 5*s.* to 20*s.* according to the metals and trucks used. The rest of the stock, live and dead, does not generally come to more than £1 per acre under the plough, that is being cropped or only undergoing improvement.

9. Upkeep, working, repairs, and sometimes repetition, for certain classes of work specified. Expenses of upkeep are required specially for the water-channels, which need yearly or two-yearly attention, coming to 2*s.* or 3*s.* per acre. Expenses of working are entailed by the pumps in use on the land under improvement. In general, and excepting rice which requires frequent waterings, the expenses do not exceed 4 to 6*s.* per acre per annum for each operation of irrigation or artificial drainage. When any land which has been improved is allowed to fall back again owing to bad cultivation, it must be again treated by means of improving crops, etc.; such repetition costs £1 to £3.

10. Amortisement, general expenses, taxes and interest before the land comes into full bearing. The charge for amortisement and interest on the plots put out of cultivation for improvement, and which may be worth £20 to £30, is 30 to 40*s.* per annum; for land costing, or worth, as much as £40 to £50, and not giving any returns, the charge will be 50 to 60 *s.* Land under improvement has to bear expenses of management estimated at 6 to 10*s.* per acre. The taxes on this land are generally between 2 and 5*s.*, or more for certain plots surrounded by "hods" in bearing.

The work of improvement lasts a variable number of seasons; in the best conditions two whole years, but it may be even 5 or 7 years before the land can be properly cropped without fear of a rapid falling-off of condition. The whole series of operations enumerated averages £20 to £25 per acre in favourable cases, but it may make away with £40 to £50 where the improvement is difficult and the fertility low.

1277 – The Cost of Levelling in Egypt.

CATZEFLIS, EMILE. Les nivellements et leur prix de revient. - *Bulletin de l'Union des Agriculteurs d'Egypte*, 10e Année, Nos. 82 and 86, pp. 1-7 and 102-109. Le Caire, janvier and mai 1912.

The system to be adopted for levelling land in Egypt varies according to circumstances: where large amounts of soil are to be moved more than 140 to 160 yards the most economical method is to use Decauville trucks on rails; for distances between 65 and 130 yards steam levellers do best; while for small alterations it is advisable to use animals (bullocks and mules).

Levelling with bullocks. — A scoop ("kassabieh") holding one-eigth of a cubic yard, drawn by a good pair of oxen, can do 32 yards (including

both journeys, emptying and necessary stops) in about 2½ minutes; that is 180 journeys in a working-day of 7½ hours, carrying 23½ cubic yards of soil. If the scoop is bigger, the weight is greater, and the animals go slower, so that the amount carted comes out about the same.

The cost of a day's work of a bullock in Egypt is reckoned at 10 piastres (2*s.*); the price for a pair of bullocks and a man is 24 piastres (4*s.* 11*d.*), so that the cost for carting is 2½*d.* per cubic yard. Levelling with bullocks has the advantage of turning out much better work than that done by a steam leveller. But if the earth has to be moved 110 or 130 yards, bullock draught ceases to be economical. At this distance each journey to and fro will take 6 minutes, or 75 in a working-day, making nearly 10 cub. yds. of earth carted; this will cost 6*d.* per cubic yd., as compared with 2*d.* and 2 ¾*d.* with the steam leveller and Decanville trucks respectively. In these calculations and all that follow the loose soil is measured in the scoop at the end of the journey; for medium soils this value is half as much again as for compact soil in position.

Levelling with steam levellers. — Several different types of machine are used in Egypt: some, carrying only 1 cub. yard of soil, are not considered practicable; the Monnerat leveller, adopted by the Béhéra Society, carries 2½ cub. yds.; another type, made by Mc Laren, carries 5 cub. yds., but it is somewhat expensive.

The writer takes the Monnerat leveller as an example; it is 16½ ft. wide and is worked on light soil by a 12 HP. engine of J. Fowler's system. (For heavy soil either a leveller only 13 ft. wide or a 16HP. engine would have to be used, and the cost of the work would be a little higher).

Cost of Work with Steam Leveller.

Per day:		
Coal, 16 cwt. at 2*s.*		32*s.*
Oil, grease and tow		4*s.* 6*d.*
Per month, salaries and wages:		
2 engineers	£ 5 13*s.* 0*d.*	
1 driver	„ 2 1*s.* 0*d.*	
2 assistant-engineers	„ 2 17*s.* 6*d.*	
2 night-watchmen	„ 1 17*s.* 0*d.*	
Cost for salary of foreman	„ 1 0*s.* 6*d.*	
Total	£ 13 9*s.* 0*d.*	
On 20 days, per day		13*s.* 6*d.*
Per day of 3 workmen, 2 being for carting water and coal		2*s.*
Per day of 2 mules for carting water and coal		4*s.*
Amortisement and interest per day:		
Interest (including repairs and interest at 6 % on capital) at 18 % per annum on two engines with tackle and one leveller, costing £1850 = £333; divided over 220 days		30*s.*
Total cost per day		£ 4 6*s.*

The writer's observations have confirmed the figure generally recognized in practice for the time taken with a full load to go 90 to 110 yards, namely 3 minutes: this would give 200 journeys in a 10 hours' day; it may be taken at 180. The Monnerat leveller, 16½ feet wide, carries according to the looseness of the soil 2 to 2½ cub. yds. measured at the end of the journey; so 2¼ may be taken as an average. This means 405 cub. yds. per day, say 400; at £4 10*s.* per day's work this comes to nearly 2 ¾ *d.* per cub. yd.

Dragging the soil by bullocks to this distance would cost nearly twice as much. At the same time the use of the steam-leveller does not always effect a real economy, for on many farms the animals are idle between May (end of ploughing for cotton or rice) and August (beginning of ploughing for "nil" crops — berseem and maize). Two engines of 12HP. do the work of 60 bullocks. The keep of the bullocks so replaced at 6 piastres (1*s.* 2½*d.*) per head (1) comes to £3 13*s.* 4*d.* per day. The steam leveller gives an economy over bullock work of 2¼ *d.* per cubic yard of soil carried 90 to 110 yards; for the 400 cub. yds. carried per day this comes to £3 15*s.*, that is just about the same as the cost of keep of the idle bullocks, which is pure loss. Further the use of steam-levellers, and levelling in general, is only to be recommended for irregular land; on an even slope terracing is preferable. The levelling by bullocks gives a more perfect final result; and where irrigation is to be carried out the machine work should always be completed by bullocks drawing a scoop ("kassabieh"), or, if the land is under water, a long plank ("lawat").

Levelling with Decauville trucks on rails. — In the case of a large amount of earth to be carted 165 to 220 yards, a mule drawing two trucks each holding 1 cubic yard can make the journey 40 times a day, thus carrying 80 cubic yards. The cost of the work comes out as follows:

Cost of Carting Soil by Trucks on Rails.

Day's work of 2 mules	3*s.* 8*d.*
Wage of driver	10*d.*
Wages of 8 men loading and unloading	5*s.* 9*d.*
Wages of labour on laying and removing rails; interest and depreciation on outfit, upkeep and unforeseen	2*s.* 6*d.*
Total per day	12*s.* 9*d.*

The cost for carrying one cubic yard of earth 165 to 220 yards with Decauville trucks will thus be nearly 2*d* as against 4*d* with the steam-leveller, and twice as much again with bullocks.

(1) On non-working days only the cost of keep is reckoned for bullocks, all other expenses being divided over the working-days. (*Author's note*).

MANURES AND MANURING

1278 – Manuring of Bananas.

(1) Banana-Growing at Buderim Mountain. The Value of Fertilisation. — *The Queensland Agricultural Journal*, Vol. XXVIII., Part. 4, pp. 269-271 + plates 51-54. Brisbane, April, 1912.

(2) HATTRICK, J. M. Manuring of Bananas.—*Ibid.*, Part 5., pp. 342-348. May, 1912.

(3) BRÜNNICH, J. C. Banana Manuring Experiments on Buderim Mountain, Fifth Progress Report. — *Ibid.*, pp. 349-355 + plates 76-78.

(4) KNOWLES, CH. H. Nasinu Station, Bananas. — *Report on Agriculture, for the year* 1911, *Legislative Council, Fiji, Council Paper* No. 34, 16 May, 1912, pp. 1-9 (4-6). Suva, 1912.

(5) WILLIS, J. C. *Agriculture in the Tropics*, Chapt. VI., Manuring, pp. 26-28. Cambridge, 1909.

(6) DOHERTY, W. H. *The Chemical News*, Vol. 66, p. 187. (König, Chemische Zusammensetzung der menschl. Nahrungs-u. Genussmittel, IV. A., Bananen, pp. 851-852).

(7) SEMLER. *Tropische Agrikultur*, II. A., II. Bd., Bananen, pp. 173-204.

As J. C. Willis says: "manuring is in general just as necessary in the tropics as in the temperate zones, if good results are to be obtained for any length of time on the same ground," and it is the saving of the cost and trouble of manuring which is one of the most attractive features to both European planters and natives, who alike prefer to get new forest land to plant upon. The problems arise: how, how much, and when to manure in the tropics? These are new problems when compared to the corresponding ones in the temperate zones.

Among these problems, banana manuring is one of actuality; and some experimental data obtained lately in Queensland and Fiji may prove of practical bearing to the other banana-producing lands. As, says Mr. Hattrick, what is possible in Australia can hold good also elsewhere; at least, results of manuring as favourable as those obtained in Queensland may there also be achieved.

1. *Banana Soils and Food Requirements.* For three years, official experiments of the Queensland Department of Agriculture have been carried out by J. C. Brünnich, Chief Agricultural Chemist. These experiments, which will be continued, have been planned with the object of finding out the most suitable combination of artificial fertilizers for bananas.

In the data published by J. C. Brünnich, one of the most striking points is that chemical analyses of virgin and worn-out banana lands have shown the so-called exhaustion of their available plant food.

Analyses of friable red loam of volcanic origin.

	(a) In virgin state.		(b) Exhausted by 20 years cropping.	
	Soluble in hydrochloric acid of s. g. %	Soluble in 1 per cent. citric acid. %	Soluble in hydrochloric acid of s. g. %	Soluble in 1 per cent. citric acid. %
Potash	0.109	0.0400	0.067	0.0035
Phosphoric acid. . .	0.255	0.0142	0.338	0.0034
Lime	0.450	—	0.180	—
Nitrogen	0.560	—	0.292	—

From these figures it is seen that in this particular instance the exhausted land contained less than $^{1}/_{10}$ the available potash, and not quite ¼ as much available phosphoric acid as the similar virgin soil. Small wonder that the worn-out land no longer gave profitable banana crops. The full significance of these figures can, however, only be grasped by studying them in conjunction with the actual food requirements of the plant, as indicated by its chemical composition, and as found by the same authority.

Analyses of Banana Plants and Fruits.

(Average of 3 varieties: Lady's Finger, Cavendish, Sugar).

	In plants. lbs. per acre	In bunches. lbs. per acre	Total lbs. per acre
Potash	193.6	77.88	271.48
Phosphoric acid . .	14.0	8.52	22.52
Lime	90.0	3.15	102.15
Nitrogen	55.8	28.74	84.54

Nothing could be more striking than the enormous quantity of potash in both plants and fruit. Considering the fruit alone, which is the only part of the plant really lost to the soil, it is seen to contain twice as much potash as all the other manurial ingredients put together. This relatively enormous quantity of potash must be absorbed by the plant in a few months, so that the banana cultivation must be abandoned as soon as the soil has been depleted of its readily available plant food, because not only must the plant absorb all the manurial constituents contained in the fruit, but also the large quantities of those substances required to build up the plant body itself. Taken together, the quantities of manurial ingredients in plant and fruit are enormous, and they must be present in the soil in readily available form if the quickly growing plant is to produce fruit at all and here we have the secret of the rapid exhaustion and consequent abandonment of even the richest and most fertile banana lands.

But need these lands be abandoned? Is it not possible in the case of bananas, just as with all other crops, to return to the soil the plant food constituents removed and to maintain indefinitely the productiveness of the plantation? These questions have been auswered in the affirmative, as far as the following experiments have been carried out.

2. *Official experiments.* — Final results of the official experiments of the Queensland Department of Agriculture have not yet been published, but so far as the Fifth Progress Report on the experiments goes, the great advantages of thorough and deep cultivation combined with a liberal application of artificial fertilisers remain clearly proved.

The bases of the complete manures used in these experiments are (per acre):

Potash:

160 lbs. as 320 lbs. potassium sulphate.

Nitrogen:

40 » » 290 » dried blood.
40 » » 290 » nitrate of lime.
40 » » 200 » ammonia sulphate.

Phosphoric acid:

80 lbs. as 470 » superphosphate.
80 » » 470 » basic slag.

Dressings were also given in double and half quantities, all manures being applied twice a year. On all experimental plots green manure crops were grown between the bananas; and some portions were salted, or limed, as well as salted and limed.

With regard to the advantages of either superphosphate or basic slag, no definite conclusion can be drawn from the first series of experiments; but the superiority of blood and of nitrate of lime as a source of nitrogen over sulphate of ammonia is quite apparent. It is further evident that only soils with a fairly large amount of humus will grow bananas successfully, and the humus can easily be supplied by suitable green-manure crops, as Mauritius bean, cowpea and pigeon-pea. The leguminous crops, however, do not do so well, when the soil is deficient in lime.

As to the amount of fertilisers to be applied, the double quantities seem to give the best results. In conclusion, these experiments show that bananas can be grown profitably, even on old exhausted banana lands, by the aid of heavy applications of artificial fertilisers, costing, with two dressings of the double standard amounts, about 1 *s.* 3 *d.* per stool annually. The advantages of using old lands are many, and should amply pay for the heavy cost of fertilisers.

3. *Practical experiments.* — The following table gives a summary of the results of some trials arranged in five Queensland plantations, and of two experiments carried out in Fiji, one of which was an official experiment of the Department of Agriculture, at the Nasinu Experiment Station.

A study of this table will show that in every case the planters have received very handsome returns for the money spent on potash. The net profits are in each case calculated from the value of the crop as stated by the experimenter from the ruling market price on his plantation at the epoch in which the experiment was carried out. The figures, therefore, afford a very fair criterion of the returns to be expected from the judicious use of potash manures. The result of averaging all the figures is that for every 1*s.* spent on potash, the planter receives 6 *s.* in return.

4. *A suitable standard dressing.* — Many of the Queensland experimenters reported, however, that they considered the dressings, as given in the table above, were insufficient, and from the results of all the experi-

Results of Fertilisers Experiments on Bananas.

	Fertilisers applied in cwts. per acre			Yields per Acre			Value of increase due to Potash (per acre)	Cost of Potash (per acre)	Profit per acre due to Potash	REMARKS
	Sulphate of Potash	Super-phosphate	Sulphate of Ammonia	Bananas	Crop increase per acre (*a*) Over Unmanured	Crop increase per acre (*b*) due to Potash				
	Cwt.	Cwt.	Cwt.	Dozen	Dozen	Dozen	£ s. d.	£ s. d.	£ s. d.	
1	—	—	—	1 500	—	—	—	—	—	On sandy loam near sea level; two years planted.
2	—	1 ½ conc.	1	1 690	190	—	—	—	—	Variety: Cavendish. Price, 1 ½*d.* per dozen.
3	1 ½	1 ½ do	1	3 000	1 500	1 310	8 3 9	1 2 6	7 1 3	
1	—	—	—	1 000	—	—	—	—	—	Light sandy loam, well sheltered. Rainfall for year, 60 in.
2	—	4 ord.	1 ½	1 400	400	—	—	—	—	
3	2	4 do	1 ½	2 090	1 090	690	5 15 0	1 10 0	4 5 0	Variety: Cavendish. Price, 2*d.* per dozen.
1	—	—	—	890	—	—	—	—	—	Sandy loam, good, deep, well drained soil. First crop.
2	—	4	1 ½	1 200	400	—	—	—	—	
3	2	4	1 ½	2 200	1 400	1 000	8 6 8	1 10 0	6 16 8	Variety: Cavendish. Price, 2*d.* per dozen.
1	—	—	—	1 290	—	—	—	—	—	Worn-out red volcanic soil, 800 ft. above sea level, well drained.
2	—	3	1 ½	1 480	190	—	—	—	—	
3	2	3	1 ½	2 630	1 340	1 150	13 7 6	1 10 0	11 17 6	Crop at 3 *d.* per dozen.
1	—	—	—	2 650	—	—	—	—	—	Volcanic soil of good quality, but rather porous: 500 ft. above sea level.
2	—	3	1 ½	7 200	4 550	—	—	—	—	
3	3	3	1 ½	9 400	6 750	2 200	32 1 8	2 5 0	20 16 8	Crop at 3 ½*d* per dozen.
				Bunches	Bunches	Bunches				Rich alluvial loam. Experimenter regarded test as very satisfactory, and thought, given favourable weather conditions, it would have been more so.
1	—	—	—	400	—	—	—	—	—	
2	—	3	1 ½	400	—	—	—	—	—	
3	1 ½	3	1 ½	560	160	160	8 0 0	1 4 0	6 16 8	Crop at 1*s.* per bunch.
				% Bunches large	% Bunches small					
1	—	—	—	25.7	74.3	—	—	—	—	Large bunches are those over 8 "Hands."
2	—	4	1	74.1	25.9	—	—	—	—	Value based on crop at 9*d.* for large, 6*d.* for small bunches.
3	3	4	1	66.2	33.8	—	6 2 6	2 5 0	3 17 6	

ments, as well as from Brünnich's data, everything points to the following as very suitable:

Standard dressing for bananas per acre.

Sulphate of potash (96 per cent. pure)	2 ½ - 6 cwt.
Superphosphate (17 per cent. water-soluble phosphoric acid) .	3 - 4 cwt.
Sulphate of ammonia (20 per cent. nitrogen)	1 ½ - 2 cwt.

Equivalent quantities of phosphoric acid and nitrogen may also be given in other forms — for example, organic, such as meatworks refuse, dried blood, etc.; and as it has been already shown, dried blood and nitrate of lime should be preferred to sulphate of ammonia, as sources of nitrogen. In any case it is essential, in the cultivation of bananas, to maintain an ample store of humus in the soil, and also to apply at regular intervals dressings of lime.

5. *An important point.* — This is the influence of the manure on the size of the bunches. The relative proportion of large to small bunches is of great commercial importance, because the price obtained depends so largely on the size of the bunch.

In the experiment conducted by the Department of Agriculture in Fiji, an attempt was made to determine the influence of the manure on the size of the bunch. It was found that, while on the unmanured plot only 25 per cent. of the bunches were large, *i. e.* over eight hands; on the plot receiving phosphoric acid and nitrogen, 74 per cent. were large. On the plot receiving potash, phosphoric, and nitrogen, 66 per cent. were large bunches, and, although this proportion is lower than from the plot without potash, the absolute yield was so very much more from the complete manure that the extra outlay for potash was amply justified.

6. *A caution.* — Data on optimum quantity of humus in a soil for bananas are not available, but there is no doubt that abundance is, as above pointed out, very essential. In the tropics, however, and particularly on soils devoted to bananas and also pineapples, the organic matter becomes rapidly depleted; and mineral artificial feritilisers used alone, while supplying abundant plant food, will fail to give such profitable returns as organic fertilisers such as dried blood, meat-works refuse, etc!, as well as green manure, for the simple reaon that they tend, when used alone to alter for the worse the physical condition alone, while the organic manures used together with lime, tend to improve it, in addition to supplying essential plant foods.

It is difficult to lay down hard-and-fast rules for the manurial treatment of any crop, and all planters who intend using artificial fertilisers should test these recommendations by practical trial before adopting them throughout a whole plantation; but there is no doubt than on the lines

indicated, and with the ever essential concomitants of lime, humus and good cultivation, manuring will profitably increase the banana crop, while maintaining the fertility of the plantation and the size of the bunches.

a279 – Studies in Catalytic Fertilizers. (1)

BOULANGER, E. Etudes sur les Engrais Catalytiques. — *Annales de l'Institut Pasteur*, XXVI Année, Tome XXVI, No. 6, pp. 456-466. Paris, 25 juin 1912.

Since Bertrand and Thomassin made known the results obtained by them in the use of catalytic fertilizers, many other experiments have been carried out on the same substances in different countries, but with doubtful results. The writer thought it would be interesting to study the question by means of the precise method of pot culture. Experiments were made in 1908, on potatoes ; in 1909, on potatoes and brewing-barley ; in 1910 on oats, peas, and clover ; in 1911, on kitchen-garden plants.

From the results obtained, the writer draws the following conclusions :

1. The first experiments on the potatoes seemed to confirm the favourable action of manganese salts ; while those on brewing-barley appeared to show that, in the majority of cases, the action of manganese chloride on brewing barley was nil.

2. Manganese fertilizers hed no perceptible action on oats, peas and clover, whether used alone, or with a phosphatic or nitrogenous fertilizer. The presence of potassic fertilizers, on the contrary, scemed to help out the action of the manganese. These results explain a certain want of success which may arise in the use of fertilizers containing manganese.

3. With regard to vegetables, aluminium sulphate has at first considerable effect on carrots, celery, potatoes, chicory and onions : its action is doubtful on haricot beans, spinach and sorrel. Manganese sulphate has considerable effect on carrots, celery, sorrel, lettuce and beetroot, and its action on spinach is perceptible, while it is doubtful or absent on onions, chicory and haricot beans. The action of sodium silicate is considerable on celery and potatoes, very noticeable on carrots, non-existent in the case of onions and chicory, harmful on spinach and sorrel. Ferrous sulphate has considerable effect on celery and potatoes, a perceptible action on lettuce and onions, none, or a doubtful one, on carrots and haricot beans, while it is injurious to spinach, sorrel and chicory. The action of flowers of sulphur is in all cases favourable ; it is especially noticeable on carrots, lettuces, sorrel and potatoes. Uranium sulphate appears to act favourably on beetroot.

(1) See *B.* May 1912, Nos. 779 and 780. (*Ed.*)

4. If each vegetable is taken separately the catalytic fertilizers can be arranged in the following order of decreasing activity, leaving out of account such as have no effect upon them, or an unfavourable one.

Carrot : sulphur, aluminium sulphate, manganese sulphate, sodium silicate.

Haricot beans : sulphur.

Celery : sulphur, ferrous sulphate, sodium silicate, manganese sulphate, aluminium sulphate.

Spinach : sulphur.

Lettuce : sulphur, manganese sulphate, ferrous sulphate, aluminium sulphate.

Sorrel : sulphur, manganese sulphate.

Chicory : sulphur, aluminium sulphate.

Potato : aluminium sulphate, sodium silicate, ferrous sulphate, sulphur.

Onion : slight favourable action of aluminium sulphate, ferrous sulphate, and sulphur.

A second experiment with flowers of sulphur seemed to confirm the opinion that the fertilizing action of this substance was only indirect and due to its modifying the soil bacteria and hindering the development of certain organisms.

1280 – **Agricultural Progress and Consumption of Chemical Manures in Russia** (1).

1* SMITH, C. S. (H. M. Consul-General at Odessa), Russia, Fertilisers. *The Board of Trade Journal*, Vol. LXXVIII, No. 815, pp. 73-74 (74). London, July 11, 1912.

2*. Handel. Winke für den Export. Kunstdünger — *Das Handelsmuseum*, Bd. 27, Nr. 24, pp. 349-353 (350). Wien, 13. Juni 1912.

There has lately been a substantial growth in the consumption of chemical manures in Russia ; this may be attributable either to the agricultural progress of the country or to partial exhaustion of the high fertility of the black soils in particular. In any case the increase in the imports of manures is an indication that the Russian agriculturist has recognised the advantage of chemical manuring either for keeping up high yields or for bringing them up to the level attained in the countries of Western Europe.

In order to form some idea of the possibilities of consumption of chemical manures in Russia, it will suffice to consider that on the basis of a consumption of 2 880 000 tons for Germany, Russia should consume 12 800 000 tons, while at the present time she only consumes a maximum

(1) For the question of phosphates in Russia, see *B.* June 1912, No. 898. (*Ed.*).

of 640 000 tons. This consumption is supplied in great part by imports, which during the five years 1907-1911 were distributed as follows:

Total Imports of Manures into Russia, 1907-1911.

	Quantity: tons	Value: £
1907	117 590	275 100
1908	152 800	269 300
1909	193 270	488 800
1910	274 210	659 850
1911	324 160	761 900

The importation of basic slag has risen to 141 000 tons in 1911, *i.e.* almost double that of 1908. The home production is confined to that of a single establishment with an annual output of about 16 000 tons.

In Russia there are no nitrate deposits which could be conveniently utilised ; for this reason the needs of the country are imported almost exclusively via Hamburg. Sulphate of ammonia is produced in some quantity as a by-product in some industries, such as gas works, blast furnaces; etc.; it is however but rarely used as a manure. Consumption would be promoted by a reduction of prices: from this point of view importance attaches to the coke furnaces in the valley of the Donetz, which will very shortly produce substantial quantities of sulphate of ammonia.

Potash salts are likewise not found in Russia under conditions allowing of their convenient utilisation, so that they too must be imported.

In conclusion it should be observed that chemical manures are at the present time not obtainable cheaply in Russia, as they have to be carried from long distances and pass through many intermediaries. In short, there is a good deal still to be done, especially in the reduction of the costs of transport, before the use of chemical manures becomes general in Russia.

1281 – **Influence of Sudden Changes of Temperature on the Respiration of Plants.**

AGRICULTURAL BOTANY. CHEMISTRY AND PHYSIOLOGY OF PLANTS

BLANC, L. Influence des variations brusques de température sur la respiration des plantes. — *Comptes Rendus de l'Académie des Sciences*, Tome 155, No. 1, pp. 60-63. Paris, 1er juillet 1912.

The Author has taken up again the classical studies of W. Palladine on the action of sudden variations of temperature on the respiration of plants. Placing himself beyond the reach of the criticism directed against these experiments, which had been made on various groups of seedling beans grown for several days in saccharine solutions at different temperatures, so that they were no longer comparable at the time of experiment, he adopted the following technique:

He took seedlings of *Phaseolus vulgaris* L. deprived of their cotyledons and grown in distilled water, shoots of *Vicia Faba* L. and young leaves of *Secale cereale* L. which had previously been placed in a 10 % saccharine solution. In each experiment he took only one group in order to avoid the individual differences always presented even by groups similar to each other. The study of respiration was made by the method of confined air, subjecting the graduated test vessels in which the respiration took place successively for a given time (usually very short) to the different temperatures provided for in the experiment. At the end of each experimental phase, before renewing the air in the tube, a quantity of gas is taken out and the carbonic acid measured by the Bonnier and Mangin apparatus.

From these new experiments it appears that sudden variations in temperature do not give rise to any stimulus to respiration and that between the respiratory activity corresponding to a given temperature and that for a different temperature, the transition takes place gradually and comprises all the intermediary respiratory activities between those of the extreme temperatures.

1282 – Electrolytic Effects of Continuous Electric Current on the Cells of Living Plants.

KÖVESSI, FRANÇOIS. Effet électrolytique du courant électrique continu sur les cellules des plantes vivantes. — *Comptes Rendus de l'Académie des Sciences*, Tome 155, No. 1, pp. 63-66. Paris, 1er juillet 1912.

In a previous note (1) the Author demonstrated that the intensity of effect of continuous current on germination and on the growth of the plants depends on various physical, chemical and biological factors. With these new experiments carried out by the action of continuous current on the soil, in which wheat seeds had been sown in regular rows, the Author shows that electricity has a direct influence on the growth of the plants, and that this influence is injurious because it results in the emigration first of all of the electrolytic substances and then of the albuminoid bodies of the seeds. The shoots, owing to the quantity of substance lost, become less vigirous ; and naturally if the quantity of electricity traversing a cell, a seed or a plant is sufficiently large, a state will result in which a considerable quantity of electrolytes and albuminoid substances escapes, so much so that the cell is impoverished and the plant dies.

The following are the facts brought out by these experiments :

1. Continuous electric current has not only an indirect but also a direct influence on living plants.

2. The direct influence of electricity on living plants is based on electrolytic phenomena.

(1) See *B.* April 1912, No. 641. (*Ed.*).

3. The protoplasmic membrane, owing to the effect of the electricity, loses its semi-permeable character and allows the escape of the electrolytes from the cells.

4. Under the influence of electricity the albuminoid substances of the cells behave like electrolytes and their ions migrate from the cells and travel towards the positive or the negative electrode according to their electrolytic nature.

1283 – The Synthesis of Proteid Substances by Higher Plants in Sterilized Cultures in the Dark.

SCHULOW, Iv. Obrasovanie Bielkov Visscim Rasteniem v Temnotie (V Sterilnoi Kulturie). — *Jurnal Opétnoi Agronomii* (Review of Experimental Agriculture), T. XIII, Kniga 2, pp. 207-209. S. Petersburg, 1912.

This paper gives the results of many experiments made by the writers for the purpose of studying the formation of proteid substances by plants kept in the dark. The question is no new one, but the method adopted — perfect sterility of the cultures, the use of entire plants, and not of organs or fragments, the presence of a hydrocarbon in the free state —, render these experiments especially interesting. The plant selected was maize and the hydrocarbon, a 3.2 % solution of saccharose. The seeds were placed in 6 vessels ; in two of these no germination was observed ; in the others, the young plants developed normally affording the following data :

	Weight (dry) of one or two grains sown	Weigh (dry matter) of the plants	Increase of dry matter	Contents in proteid matter of grains sown	Proteid content of the plants	Proportion betwen the proteid matter in the grains sown and that in the plants
	gr.	r.	gr.	mgr.	mgr.	
Ammonium sulphate: 2 plants.	0.3556	0.57	0.2144	6.81	10.43	100 : 153
Ammonium sulphate and ammonium nitrate : 2 plants .	0.3556	0.74	0.3844	6.81	13.83	100 : 203
Ammonium sulphate and ammonium nitrate : 1 plant	0.1778	0.29	0.1122	3.40	6.30	100 : 188

In spite of the conditions of the nutritive substrata, the plants developed in the dark, although slowly. At the end of the third week, the extremities of the leaves began to turn yellow and became shorter, all sign of growth having ceased. The development of the root system also was slow ; with ammonium sulphate the roots remained short and thick ; but their development proceeded normally on the addition of a little ammonium nitrate.

It was, however, observed that the subterranean portion of the plant was larger in comparison with the whole (0.84) when sulphate alone was used, being reduced to about half (0.40 to 0.45) by the addition of the nitrate.

The plants were gathered 34 to 43 days after germination, at which time the growth had already ceased for some time : thus the results of the different cultures were comparable. An accurate analysis of the control assured once more the perfect sterility of the cultures.

From the data given in the table, the following general conclusions may be drawn :

1. Although the crop was small, the increase in dry matter was always very noticeable, which again proves that the higher plants are capable of assimilating organic matter in a non-nitrogenous form, when supplied to them.

2. Ammonium sulphate hinders plant growth ; but this unfavourable effect can be eliminated by the addition of nitrate.

3. The plants collected showed an increase, in comparison with the grains sown, of 53, 88 and 103% of proteid matter.

1284 – **The First Stages of Development in the Gramineae.**

BIELAEV, A. Pervonacialnaia Stadii v Rasvitii Slakov. — *Isviestiia moskovskago Selskokhosiaistvennago Instituta* (Report of the Agricultural Institute of Moscow), God XVIII, Kniga 2, pp. 193-198. Moskva, 1912.

In the first stages of its development, the hypocotyl in the Gramineae is covered by a hood-like bract, the coleoptyl, which precedes it during growth through the soil and protects it from contact with soil particles and from variations of temperature, which might easily cause injury to its delicate newly-formed tissues.

It seems to possess, in addition, the function of transmitting to the seedling the impressions concerning light which influence the formation and position of the first node. In this article, the results of numerous researches on the morphological and physiological significance of the coleoptyl are given. Two species of Gramineae, barley and oats, were examined, two cultures of each being made in vessels filled with sand. A hundred grains were sown in ten rows in each vessel, every row at a different depth, from one to ten centimetres progressively.

One vessel was placed in the light, the other in the dark.

Depth of sowing	1 cm.	2 cm.	3 cm.	4 cm.	5 cm.	6 cm.	7 cm.	8 cm.	9 cm.	10 cm.
Length of coleoptyl . . .	1.5	1.7	2.4	3.5	3.9	4.4	5.5	6.7	7.6	8.5
Distance of first node from the surface of soil. . . .	0.5	0.5	0-8	1.2	I.5	2	2.2	2.5	2.8	3

From this table, it is seen that the length of the coleoptyl is in direct relation to the depth of sowing, which confirms its mechanical function of covering. With regard to the distance of the first node from the surface of the soil, it is greater in proportion to the depth at which the seed is planted, though the relation is not so exact as in the former case. The plant has a tendency to form its first node in proximity to the surface of the soil and to neutralize the effect of deep sowing by an increase in the growth of the first internode. This is due, as will be seen later, to the different degrees of illumination at the various depths.

Experiments in the dark.

At first sight, the most striking thing is the different external appearance of the barley and the oats ; the latter has a single elongated slender stem with an imperfectly developed first node. Further, in oats, the coleoptyl, instead of being inserted in the base of the hypocotyl stem, occurs much higher up at the place where the first node will be formed later. The length of the coeloptyl is not influenced much by the actual depth of sowing, but is determined by the different condition of illumination. The greater the depth, the less light is available, and the growth of the plant is thus accelerated.

It is to this condition that the writer attributes the variation in the distance of the first node from the soil. The deeper the seed is sown, the less light is received by the young stalk in the first stages of its development; this results in a more energetic growth and gives rise to the tendency of bearing the first node at a higher level.

The problem is not without some practical interest. In order to keep the first nodes of cereals below ground, and thus protect them from the frost, it is only necessary to sow the seeds at the proper depth.

1285 – On the Distribution of Mineral Bases in Barley during the Growth of the Plant.

ANDRÉ, G. Sur la distribution des bases minerales chez l'Orge, au cours de l'évolution de ce végétal. — *Comptes Rendus des séances de l'Académie des Sciences*, Tome 154, No. 26, pp. 1817-1819. Paris, 24 juin 1912.

In a preceding article (1), the writer has shown, that during the growth of barley the weight of the acid compounds increases continuonsly and reaches its maximum at the time of maturity.

With regard to the bases, the writer distinguishes the insoluble (lime and magnesia) from those which are soluble (potash and soda). The weight of the former continues increasing till the time of complete maturity, after which it diminishes. The soluble bases, on the contrary, gradually

(1) See *B.* Aug. 1912, No. 1152. (*Ed.*).

pass out of the plant from the commencement of the flowering period. In fact, the maximum weight of potash coincides with the beginning of the flowering period ; from this time, the potash diminishes in the whole plant. The ears, however, contain a maximum at the time of complete maturity, though the plant as a whole eliminates a proportion of 17.6 % of this alkali. The maximum weight of soda is met with already before flowering ; when the period of maturity has passed, this base is eliminated in the proportion of 66.7 % ; that is to say, the soda is more completely got rid of than the potash, because the part played by the former in the processes of plant nutrition is of secondary importance.

In conclusion, according to the researches of the writer, barley loses by excretion no nitrogen, sulphur, lime or magnesia in the course of its growth to complete maturity ; considerable amounts of potash and soda are lost, so that the weight of these substances is less when the plant is mature than at previous stages of its growth. Potash and soda are, however, eliminated in very unequal proportions, the weight of the potash retained by the plant always much exceeding that of the soda.

SELECTION

1286 – **Altering the Composition of Indian Corn by Seed Selection.**

SMITH, L. H.—*The Journal of Industrial and Engineering Chemistry*, Vol. 4, No. 7, pp. 524-525. Easton, Pa., July, 1912.

Experiments were undertaken at the Illinois Station to influence the composition of the Indian corn grain by selection and breeding, in four different directions :

1) increase the protein content ;
2) decrease the protein content ;
3) increase the oil content ;
4) decrease the oil content.

Starting in 1896 with a variety known as Burr's White, 163 ears were chosen and analysed, determinations being made for protein, oil, ash and carbohydrates. According to the percentage of the constituents, 4 lots of these ears were picked out with which to start the 4 respective breeding plots : a high protein plot, a low protein plot, a high oil plot, a low oil plot. Each ear was planted in a separate row, the different plots being isolated in order to avoid contamination from cross pollination. From the harvest a large number of ears were analysed from each plot, and upon these results ears were selected for seed with which to plant the respective plots the following year. This general plan has been followed for 14 generations. In this manner four different strains emanating from the same variety have been derived. Their gradual evolution is shown in outline by the following two tables :

BREEDING FOR HIGH AND LOW PROTEIN.

Average per cent. protein in crop each generation.

Year	High protein	Low protein	Difference
1896	10.92	10.92	0.00
1897	11.10	10.55	0.55
1898	11.05	10.55	0.50
1899	11.46	9.86	1.60
1900	12.32	9.34	2.98
1901	14.12	10.04	4.08
1902	12.34	8.22	4.12
1903	13.04	8.62	4.42
1904	15.03	9.27	5.76
1905	14.72	8.57	6.15
1906	14.26	8.64	5.62
1907	13.89	7.32	6.57
1908	13.94	8.96	4 98
1909	13.41	7.65	5.76
1910	14.87	8.25	6.62

BREEDING FOR HIGH AND LOW OIL.

Average per cent. oil in crop each generation.

Year	High oil	Low oil	Difference
1896	4.70	4.70	0.00
1897	4.73	4.06	0.67
1898	5.15	3.99	1.16
1899	5.64	3.82	1.82
1900	6.12	3.57	2.55
1901	6.09	3.43	2.66
1902	6.41	3.02	3.39
1903	6.50	2 97	3.53
1904	6 97	2 89	4.08
1905	7 29	2 58	4.71
1906	7.37	2.66	4.71
1907	7.43	2.59	4.84
1908	7.19	2.39	4.80
1909	7.05	2.35	4.70
1910	7.72	2.11	5.61

Summing up these results it may be said, that starting with a variety of corn of average composition it has been possible by 14 years of breeding to increase the protein content from 10.92 per cent. in the original to 14.87 per cent. in the crop of 1910 ; and at the same time by selection in the opposite direction, to decrease this constituent to 8.25 per cent. Even more striking changes than these have been produced in the oil content : this has been increased from 4.70 per cent. in the original to 7.72 per cent.

in the crop of 1910, while at the same time in another strain it has been decreased to 2.11 per cent. That is, out of a single variety of corn two strains have been developed of which one is now nearly twice as rich in protein as the other, and two other strains have been developed, the one of which is now more than three times as rich in oil as the other.

As to the effect of this selection upon the composition of parts of the plant other than the kernel, it is stated in a general way that no pronounced changes have been found resulting from the changes produced in the grain. Another practical question is that regarding the effect of this selection upon productive qualities. The writer states that the yields have, in general, been quite well maintained. Selection for high protein seems to have been accompanied by a somewhat diminished yield as measured by bushels of corn per acre. Taking, however, the basis of pounds of protein per acre, the high protein strain is sufficiently higher in percentage to yield more protein per acre than the ordinary varieties tested.

In conclusion, attention should be called to the influence exerted upon the protein as well as the oil content by environmental conditions, especially those due to differences of seasons. But by having a " high " and a " low " plot of each, a check is obtained allowing of the elimination of these seasonal effects to some extent.

1287 – Selection of Flax in Russia.

ALTHAUSEN, L. Is Oblasti Sortovodstva Lna. — *Jurnal Opétnoi Agronomii* (Review of Experimental Agriculture), God XIII, Kniga 2, pp. 161-184. S. Peterburg, 1912.

There are here set out the results of the experiments conducted by the Author in the Station of Agricultural Chemistry of St. Petersburg, in relation to the selection of flax during the period 1909-1911. In 1909 five plots were chosen and on each of them three different types of flax were sown, namely type No. 5 supplied by Vilmorin as " lin commun "; No. 1 coming from Pskow, and No. 2 from the Baltic Provinces of Russia.

At the time of crop (1909) there were determined for each type the average length of the stems (from the base of the stem to the insertion of the first branch) in 100 specimens per plot, thus aggregating the total of 500 measurements for each type.

The following were the averages obtained :

Type	No.	1	Length of stems	49.7	cm.
"	"	2	" "	43.6	"
"	"	5	" "	33.1	"

The greatest length is therefore given by No. 1, followed by 2 and 5.

The seed of the 1909 crop was sown in 1910 in the following proportions: No. 1 on four, No. 2 on eight and No. 5 on four plots.

On each plot there was then measured the total (absolute) height of 50 plants, the following values being obtained:

No. 1 Height in cm. 87.5; 88.0; 90.5; 92.1
No. 2 " " 81.1; 82.9; 83.4; 84.4; 85.5; 86.2; 88.6
No. 5 " " 71.2; 74.2; 74.8; 75.7

Averages;

No. 1	Height in cm.	89.6
No. 2	" "	84.5
No. 5	" "	74.0

With regard to the character "height of the plant" the different types therefore succeed each other in the same order as in the previous year for he character "length of stem." This latter character likewise, in so far as it is possible to infer from the few determinations, follows the like rule in 1910:

No. 1	Length of stem in cm.	73.6
No. 2	" " " "	70.4
No. 5	" " " "	57.9

The same conclusions had 12 years back been reached by Schindler, who asserted that "Russian flaxes are not 'local mutations' (produced by the effect of mutation), but true and genuine distinct races, which retain unaltered through the most varied conditions of environment their differential characteristics, which have become stable in the course of time as a result of natural selection."

During the course of the present experiments the soil formed anything but a uniform factor: in 1909 it was poor soil, coarsely sandy, and in 1910 a soil with fine sand and rich in humus; in 1911 uncultivated, clayey meadow soil exceedingly rich in humus, and tenacious.

In 1909 the following interesting experiment was also carried out: of type No. 2 three comparatively high plants (84 to 99 cm.) were selected, which in 1910 yielded 61 specimens with an average height of 106.4 cm.; and five relatively low plants (50-79 cm.), which in the following year produced 69 descendants, averaging 86.2 cm.

The same relation is also observed in 1911: in the descendants of the high plants selected (1909) we have a height of 64.1 cm. (on the basis of 768 measurements) and for the low (1909) 50.2 cm. The fact emerges still more clearly from the following table:

Number of Plants and average height of the descendants in 1911.

From high plants selected in 1909:	
Height in cm.	59.8; 63.8; 67.8.
Number of plants	154; 386; 228.
From low plants selected in 1909:	
Height in cm.	47.2; 48.8; 50.8; 60.3.
Number of plants	229; 327; 198; 100.

Therefore as regards the character "height" there is a noteworthy and evident parallelism between the plants selected in 1909 and their descendants for two generations down to 1911, which is the more significant inasmuch as the initial choice was made at haphazard without even taking account of the agrogeological conditions. From this fact it may justly be inferred that type No. 2 is not pure but is made up of a mixture of two distinct races with long and short stems, and these races, as they may be easily isolated, in view of the constancy of the distinctive character, offer fresh material for the work of selection of flax.

A large number of other investigations as to the thickness of the stalk, mode of branching, number of inflorescences, the lilac colour of the petals, point to a certain degree of stability in these characters ; the data however are as yet too few to allow of definitive conclusions being drawn.

1288 – Influence of Crossing in Increasing the Yield of the Tomato.

WELLINGTON, R. *New York Agricultural Experiment Station, Geneva, N. Y., Bulletin* No. 346, 76 pp. March 1912.

Experiments on tomato crosses were conducted at the New York Agricultural Experiment Station, Geneva, during the years 1907-1910. All the experiments have given consistent gains in favour of the yield of the first filial generation ; the second and third generations have fallen off in yield in direct ratio to the decrease in the number of heterozygous plants, *i. e.* those formed by the elements of different stocks. When the presence of the same elements, *i. e.* a homozygous condition for all the plants in a strain, has been obtained, the average yield of the plants should remain constant from year to year, varying only with the external factors, food, moisture and temperature. Thus, if the third generation plants which were used for the production of the fourth generation grown in the summer 1910 were mostly homozygous, the non-drop in yield can be understood.

These results warrant the production of first generation tomato seed not only by the grower but by all seedsmen who wish to furnish the best grade of seed to their buyers. The production of such seed requires time and care ; consequently, it must be sold at higher prices.

It will be then of some interest to give a few practical suggestions for growing commercial hybrid tomato seed.

1. Desirable results have been obtained by selecting plants indiscriminately, but better results would undoubtedly have been obtained if high-yielding mothers had been selected for one or more generations previous to the first crossing. This selection can be easily accomplished, as tomatoes are readily self-fertilised. The high-yielding strains or pure lines having been isolated, they should be preserved for future crossing. This is a very important consideration in order to put the same grade of product on the market from year to year. As tomato seed remains fer-

tile 3 to 7 years, a grower does not need to make his crosses oftener than once in three years. The seedsman can profitably raise first generation seed, provided a guarantee is not given for more than one generation.

2. Too violent crosses should be avoided, as they may lead to weakness and sterility. The best results of crossing can probably be obtained by keeping within a species and crossing the distinct varieties and the distinct strains. To secure a desirable commercial tomato, one must keep in mind the inheritance of such qualities as smoothness, colour, size, shape and earliness:

a) to obtain smooth fruits, one should cross only varieties with smooth and even surfaces, as roughness will appear in the first generation if one of the parents has this character;

b) as to the inheritance of colour, it is known that the dark red is dominant to the pink and the yellow, and that the pink is dominant to the yellow colour; thus, to obtain a red fruit, it is necessary that one parent is red; to obtain a pink fruit, one parent must be pink and the other parent either pink or yellow; and to obtain a yellow, only yellow parents can be used;

c) size is inherited as if it blended into an intermediate condition, and, therefore, one should cross large fruits to obtain large fruits; small fruits to obtain small fruits, and small by large fruits, or medium by medium fruits to obtain medium-sized fruits; size is probably increased to a slight extent by the heterozygous condition, but not sufficiently to be of commercial significance;

d) shape, like size, is inherited more or less as an intermediate in appearance, and, therefore, varieties not too divergent from the desired type should always be selected;

e) earliness is slightly increased by crossing, but for the attainment of marked differences, one would have to make crosses with early maturing varieties; care should be taken while working for earliness, that all other characters are all right.

In conclusion, the tomato is not the ideal plant to cross, for it requires care and time to make many crosses, but its compensating factors are the large number of seeds produced by a single fruit and the increased yield of the hybrids. The cheapness of the production of tomato seed will depend upon the number of seeds borne by a variety, and consequently, the nearly seedless varieties will be the more expensive to produce.

An adequate bibliography is appended to the Bulletin.

1289 – **Economic Wheat Production in New South Wales.** CEREAL AND PULSE CROPS

WILSON, H. C. *Agricultural Gazette of New South Wales*, Vol. XXIII, Part 6. Sydney, June 3, 1912.

The writer, Inspector of Agriculture for the Western District, out-

lines in this article the methods of land cultivation in preparation for a wheat crop, found to be more or less practised in the wheat areas of New South Wales, and their influence on the actual cost of production.

These methods can be summarized as follows:

1. Sowing in late autumn directly after autumn ploughing.
2. Sowing in late autumn after summer ploughing.
3. Sowing in late autumn directly after a summer crop.
4. Sowing after a winter fodder crop, *i. e.* land ploughed in the late spring for wheat to be sown the following autumn.
5. In a two-year rotation with winter legumes.
6. In rotation with other cereals.
7. Wheat sown after a thoroughly prepared bare winter fallow.

After a brief and comprehensive discussion of these methods the writer states that there is not a more efficacious system of land preparation for a wheat crop throughout the main wheat-producing areas of New South Wales than that of bare winter fallow. Farmers, he says, in the principal west and south-west areas of New South Wales where the rainfall is at all uncertain, will never realise the full value or profit-carrying capacity of their wheat lands until this bare winter fallowing system has come to stay and is practised before wheat without exception. Bare-fallow before wheat is highly economical from a great many points of view. Besides the many advantages which it presents in renovating and fertilising the soil and conserving moisture, unquestionably resulting in a much better yield of wheat per acre in comparison with sowing wheat directly after a summer or autumn ploughing, the practice is economical from the following facts:

That the farm work can be distributed evenly throughout the whole year, thus enabling the farmer to keep constantly in work farm hands who have become useful and well versed in the ways of the farm, and who would be hard to replace or obtain again if employment can only be found during the rush of the season, which results from the system of wheat sown after summer or autumn ploughing. This distribution of the farm work means also that the farm horses are used steadily and continuously and are not rushed for a few months of the year and turned out for the rest; the implements and plant employed in the production of wheat are used more constantly and therefore do not show depreciation through idleness. The same amount or even more work can be got through during the winter months with less strain on the horses than if they are worked during the hot days of the summer or autumn. The land during these summer and autumn months is often too hard to plough thoroughly, and the attempt will mean great expense in wear and tear of implements together with defective cultivation.

Superphosphate will respond much more readily if applied to a wheat crop sown on fallow land, because the fallow land will be able to support

the forced crop during the drier months of the growing period, through the extra amount of soil moisture that has been conserved.

Finally, by promoting a constant and definite yield of wheat through fallowing, not only is the yearly net profit of the farm increased, but the land value will be made much more constant through lean years, and considerably higher than the value fixed on land that has been subjected to rough-farming and has produced a series of irregular crops.

In other Australian States wheat land is valued at from £8 to £15 per acre, and is farmed alternately with wheat and bare fallow, which returns a very fair net profit over and above the rent on the land together with the cost of production and marketing. Excellent wheat land within easy distance of the railway and market in parts of New South Wales is absurdly cheap in comparison with the values of similar land in the other States.

The writer thefore concludes that wheat-farming can return the greatest profits in most parts of New South Wales and emphasizes the great necessity of ploughing thoroughly as early as possible in the winter months when the land is in a fit physical condition for work, following this ploughing by a constant system of spring and summer cultivation until the following autumn when the wheat crop is sown.

This means realisation of constant and definite wheat yields and consequent stability of the value of a property.

At Turretfield Farm, wheat on well worked fallow yields 39 bushels per acre, with 17½ inches rainfall during the year, of which only 7 fall during the growing period.

1290 – **Testing Barley for Sale and for Exhibition.**

GISEVIUS and SCHMIDT. Die Kauf- und Ausstellungsbonitierung bei Braugerste. — *Wochenschrift für Brauerei*, XXIX. Jahrgang, No. 28, pp. 381-384. Berlin, 13. Juli 1912.

The Agricultural Institute of the University of Giessen has already recommended many times that the value of barley for brewing purposes should be judged, not from the appearance of the grains, but from their brewing value (*brauwert*). The latter is to be determined, according to the suggestion of the Institute, in a laboratory, and is effected by means of sorting according to the weight per thousand grains, and the albumen contents of the barley. Good condition at harvesting (dryness) is also included.

As the Haase Brewery in Breslau has bought its barley according to this system for many years, the large Busch brewery at Limburg (West Germany) has declared itself willing to purchase barley according to its " brewing-value ". They have entered into an arrangement with the Limburg Agricultural Association by which they buy barley from the farmers without fixing the price at first. The barley is examined by the seed control station of the Agricultural Chamber in Giessen, according to the

above-mentioned system ; the price of the barley is determined from the result of this examination, according to a scale of value already fixed, and with reference to the quotations of the Frankfort Exchange. The prices of the best qualities, according to this valuation system, exceed the highest quotation of the Frankfort Exchange.

The writers think that the new valuation system will induce the farmer to grow barleys of better quality, and that it will be very advantageous to the brewer, as good barley is more profitable than grain of an inferior quality. They advise this system being used also in judging barley at shows, where hitherto qualities have been taken into account of little value in brewing : colour, shape of the grain, etc. ; this method of judging favours *erectum* barleys at the expense of *nutans* varieties, and should therefore be altered.

1291 – The Raising of Pedigreed Two-Rowed Barley for the American Brewing Industry.

Bock, F. The American Brewing Industry and the Raising of Pedigreed Two-Rowed Barley. — *The American Brewer*, Vol. XLV, No. 7. New-York, July 1912.

During the last decade the question of selecting the proper type of seed barley was given attention by a branch of the United States Department of Agriculture, the Bureau of Plant Industry, as well as by various agricultural experiment stations of States, for instance at Madison for Wisconsin, and at St. Anthony Park for Minnesota. The six-rowed barleys generally grown in the Middle States (Wisconsin, Minnesota, Dakota, Iowa, Illinois, etc.) are mixtures of many varieties. This fact alone will prevent any maltster from making a faultless malt from these barleys, without consenting to a large loss of material during the malting process. It is therefore without doubt a step in the right direction, to introduce and further the sowing of pedigreed barley.

The Agricultural Experiment Station at Madison, Wis., has during the last decade done very much to improve and introduce the pedigreed six-rowed varieties, Oderbrucker and Manchuria, as seed barleys ; but this step was mainly taken to give the farmer a seed which will give a barley of high feed value. A valuable brewing barley must be high in starch and relatively low in albumen. This is especially the case with the two-rowed barleys, and these barleys properly grown by the slow germinating process, give not only the best malt, but with the least loss possible during malting. The two-rowed barley malt will contain less diastase, and therefore the mashing process must be prolonged and carefully watched until perfect conversion is reached ; the resulting beer, however, after proper fermentation and the usual cellar treatment, will certainly compare favorably with any beer made from six-rowed barley malt in palatableness, oam-stability and keeping quality.

The writer has experimented for a number of years, for the Pabst Brewing Co. of Milwaukee, in the raising of barleys, using varieties which were distributed by the United States Agricultural Department for such purposes, comprising the two-rowed varieties Svanhals, Gutekorn, Princess, Primus and Chevalier, as well as the six-rowed Sexradigt. The experiments were started with relatively small quantities and the prime efforts were therefore directed towards the production of a large amount of seed, naturally studying the peculiarities of each strain at the same time.

It soon became evident that Gutekorn, Princess, Primus, and above all Chevalier, had to be discarded on account of defects such as weak straw, poor yield, pronounced tendency for lodging, while Svanhals showed improvements on the entire line. It did not only outclass in size of kernels, but produced a yield larger than obtained by the six-rowed variety. Had not extremely hot and dry weather last season influenced development of the grain before and during the time it was in the milk, the results of these tests on a large scale would have equalled, if not outclassed, those obtained by the pedigreed six-rowed varieties in other locations. As it was, Svanhals yielded in the last three years 39, 36 and 35 bushels per acre respectively, in one instance even 58 bushels per acre ; whereas the common six-rowed barley fell below 28, even to 22, and the pedigreed did not outyield the two-rowed strain.

These experiments also demonstrate, which is commonly known but not generally practised, that fall ploughing and seeding at the earliest possible time in spring are essential features for the production of conditions that will favorably influence yield and quality and will permit the development of grain before the hottest weather sets in.

A comparative study of the heads of both the two and six-rowed varieties showed that the amount of material to be transmitted from the soil to the kernels must naturally be more for the six-rowed head, since a well developed head carries about 50-52 kernels, as against 30-32 in the two-rowed variety. It is apparent that the latter, being less numerous, are better cared for and command conditions more favorable for their development. The six-rowed variety consists of two central and four lateral rows in which the members of the first differentiate from the others by variation of properties which seem to have an apparent bearing on yield and the development of the future plants. This interesting fact was brought to light by experiments carried on by Dr. Mann and Dr. Harlan of the Bureau of Plant Industry, and tend to show that the six-rowed barley, on account of this variation in structural constitution, which undoubtedly finds an expression during the growing process, is not an absolutely ideal malting variety.

These experiments with two-rowed barley have shown it to be possible to obtain a yield per acre equivalent to that of the best six-rowed pe-

digreed variety, thus perfectly satisfying the demands of the farmer in this respect. Although, so far, a barley has been obtained, comparatively high in albuminous contents, the writer believes that by certain changes in the methods of cultivation it will be possible to produce a plump not too thin-husked, mealy two-rowed barley, rich in starch and relatively poor in albumen.

The writer's experience in using the low albumen barleys for the various beers of the Pabst Co. justifies him in saying that the two-rowed varieties, if properly malted, will produce a material for brewing superior to that obtained from the six-rowed type.

In considering all the above facts he comes to the conclusion that it will be absolutely in the interst of the American brewing industry to encourage the raising of pedigreed two-rowed barley in preference to the six-rowed barley in the United States.

FORAGE CROPS. MEADOWS AND PASTURES

1292 – **Transplanting Alfalfa.**

HANSEN, N. E. in *The Breeder's Gazette*, Vol. LXXII, No. 1 (No. 1597), p. 13. Chicago July 3, 1912.

The author has conducted experiments on the transplanting of one year alfalfa or lucerne roots at the South Dakota Experiment Station and at several other places. The transplanting of lucerne is not a new practice, but doing the work by means of a standard transplanting machine such as is used for tobacco, cabbage, tomatoes, etc. is a novelty. In this manner the author was able, at Ipswich S. D., to set 100 plants per minute or 6000 per hour.

The plants are set out when they are one year old and they are taken from beds in which the seed has been sown in rows by a drill.

The author has used this method since 1907 with the new alfalfas he brought over to America from Russia and Siberia, and his example has been followed by several farmers in order to obtain seed from new varieties. When set in good garden soil 2 × 4 ft. apart plants are obtained with over 100 shoots to the crown and bearing as much as 3 oz. of seed per plant the third year. The variety was one secured in Russia by the author and named by him the "Cossack."

The author does not advise the adoption of this method on a large scale until its value has been further demonstrated. Meanwhile he gives the following reasons in its favour:

1. That each plant has several square feet of soil in which to develop freely.

2. That the plants can be easily kept free from weeds, especially from dodder.

3. That the drought-resistance would be increased by giving the plants more room.

4. That the risk of injuring the lucerne crowns by disking is avoided.

Though it is at present taught and generally accepted that injury to the lucerne crown caused by spring harrowing is of no consequence, the author is of the contrary opinion, and believes that it may have some bearing on root rot by affording easy access to injurious fungi. He says that in the East lucerne fields last for a very long time and he considers it to be due to the fact that the orientals do not mutilate their plants.

1293 - Trade in Forage and Vegetable Seeds for Mexico.

Commerce des graines fourragères et potagères au Mexique. — *Ministère de l'Agriculture, Dir. de l'Agr., Bulletin mensuel de l'Office des Renseignements Agricoles*, XI Année, No. 6, pp. 854-855. Paris, juin 1912.

Mexico offers a very large market for the seeds of forage plants (lucerne, clover, etc.) and those of cabbages, carrots, and all kinds of vegetables.

The fertility of the soil is such, that with irrigation, most plants can be cultivated there in all latitudes.

In order to compete successfully in the trade, it would be necessary to send a large number of catalogues in Spanish to all the chief farmers (" hacendados "). These catalogues could be got up very simply without costly coloured plates. It would be advisable to mention in them, that in tropical climates, seeds degenerate very rapidly and need frequent renewal. Advertisements could also be inserted in the local papers. Finally it would be well to insert in the catalogues, or distribute with the goods, practical information as to the method of sowing the seeds.

1294 - Vegetable Silks.

FIBRE CROPS

ZIMMERMANN, A. Über Pflanzenseiden. — *Der Pflanzer*, Jahrgang VIII, No. 4, pp. 177-184. Daressalam, April 1912.

The name of vegetable silk is given to certain vegetable fibres possessing a silky lustre, which until lately were either never used or employed solely for stuffing cushions, mattresses, life-buoys, etc., but which have now for some years been woven.

A preliminary chemical treatment is, however, necessary, for which the Chemnitz spinning company (of which the Director is E. A. Starke) has a patent process (1). Hitherto, the Stark system was only applied to " kapok " (2) (*Ceiba pentandra* L. = *Eriodendron anfractuosum* D. C.) and to " akon " (*Calotropis* sp.) ; it is however applicable to the weaving of various other vegetable fibres.

The fibre of *Chlorocodon Whytei* was considered at the spinning-factory of Chemnitz to be of good quality. The above-mentioned plant is a liane,

(1) See *B.* July 1911, No. 2122. (*Ed.*).

(2) For the description and botanical classification of " kapok " together with the industrial uses to which its seeds are put, see *B.* Aug.-Sept-Oct. 1911. Nos. 2593 and 2594. (*Ed.*)

which grows in the neighbourhood of Amani, though not in sufficient quantities to make its exploitation in the wild state a profitable undertaking. Whether its cultivation will pay or not, will be proved when the experiments begun at Amani are brought to a conclusion.

The fibres which cover the seeds of *Kickxia elastica* were thought well of, as were also the brown fibres of *Bombax rhodognaphalon* (a tree which is fairly abundant in the forests of German East Africa) which seem to have been imported into Europe from the Daressalam "hinterland."

The "kapok" of commerce comes, for the most part, from cultivated plants; while "akon", grows wild.

Vegetable silks, also known in commerce under the name of kapok, are derived from other Bombaceae, usually species of the genus *Bombax*, but some come from *Ceiba pentandra*; they are, however, of less value than true kapok. The latter is chiefly supplied by the Dutch Indies, although that cultivated in German Africa is not inferior to it in quality.

In 1910, about 75 000 acres were under kapok, nearly four-fifths of which were cultivated by natives. Hitherto, Europeans have either grown kapok promiscuously or to shade or support other crops; it is only recently that it has been planted as a separate crop.

The amount exported rose from about 1400 tons in 1889, to over 8 500 tons in 1910. Its price has varied during the last six years from 5½*d.* to 9*d.* per lb.

The fibres enclosing the seeds are obtained from the open fruits either by spontaneous dehiscence or by means of a blow from a wooden hammer. They are placed to dry in the sun, and separated from the seeds, either by beating them with beaters in a basket, or by shaking them and turning them over with long forks of bamboo or else by a machine. Machines furnished with saws or rollers for opening the capsules have not proved satisfactory.

In making it into bales kapok is only subjected to a medium pressure, for if it is too much compressed the fibres are crushed; a cubic yard should not weigh more than 230 to 285 lbs.

The yield of this product depends largely upon the season. Much rain during the flowering season hinders pollination; and if it occurs while the fruits are still small it blackens the fibre. If the weather is too dry, however, the fruits do not reach their full size and the fibre is short. The crop has been estimated at about 60 lbs. per acre in plantations of three years; 150 lbs. in the fourth year; 235 lbs. in the fifth and sixth years.

Mr. Mac Gillavry (*Kapokcultuur op Europeesche ondernemingen en van de Inlandsche bevolking*, Soerabaia, 1911) has estimated it at 235 to 390 lbs. per acre. Quoting kapok at 8*d.* per lb. this would give a gross return of about £2 per acre in the third year; £5 8*s.* in the fourth; £8 in the fifth and sixth; and £8 to £13 10*s.* in the succeeding years. The cost of gather-

ing, preparation, and transport to the coast is reckoned in Java at 1½*d.* to 2½*d.* per lb. of cleaned kapok, *i. e.* at half the price paid in Europe (1).

The kapok seeds weigh nearly twice as much as the fibre and contain 23 % of oil, of which 22 % can be extracted by solvents and 18 % by means of hydraulic presses.

The seeds from Java are mostly exported to Europe ; during the last six years, £3 6*s.* to £4 12*s.* per ton was paid for seeds consigned to the local port. The oil, which is used principally in the manufacture of tallow, has fetched of late years from £14 12*s.* to £23 18*s.* per ton, but usually £21 18*s.* The cake can be used as manure, but it only contains 4 % of nitrogen.

Kapok wood is rather soft ; nevertheless it is exported from Kamerun to Germany, where it is much used for veneer work.

Akon (2) comes from *Calotropis procera* and *C. gigantea*; the latter is distributed from India to South China and the Malay Archipelago, while the former has also been found on the steppes of East Africa, especially in the German colonies.

The fruits of this perennial shrub contain seeds 6 to 7 mm. in length, 4 mm. in width, and furnished with a tuft of long silky hairs.

The two species *Calotropis* differ very little from one another; *C. gigantea* yields the better fibre, but that of *C. procera* from the German colonies was considered to be of good quality. The price is so far not fixed ; the fibre of *C. procera* from Muanza, German East Africa, is valued at 5½*d.* to 6½*d.* per lb., sometimes even higher.

The akon hitherto on the market comes from India and is the product of wild plants. In the German colonies, it is doubthful whether the wild crop, allowing for the cost of transport to the port of shipping, will be remunerative.

Cultural experiments have been made but, so far, with negative results, because the plants being much attacked by insects and fungi yielded an inferior product. These experiments could, however, be continued with advantage.

(1) According to a report by the German consul at Amsterdam, 61 449 bales (each weighing 88 lbs.) of cleaned kapok and 2 335 bales of uncleaned, were imported into Amsterdam in 1911, while 3 000 bales of cleaned kapok were imported into Rotterdam during the same period, making a total of 66 784 bales, as against 67 175 bales in 1910, and 67 377 bales in 1909. Adding the 926 bales left over from last year's stock, the total amount available was 67 710 bales (compared with 82 005 bales in 1910). Of this quantity, 63 016 bales were sold. The prices per lb. for East Indies Kapok were 8*d.* to 8.3*d.* for special cleaned ; 7.8*d.* to 8*d.* for good cleaned ; 6.3*d.* to 7.8*d.* for cleaned, and 2.7*d.* to 2.9*d.* for uncleaned. *The Board of Trade Journal*, Vol. LXXVIII, No. 819, p. 352. London, August 8, 1912. (*Ed*).

(2) See *B.* July 1911, No. 2121. (*Ed.*).

SUGAR CROPS

1295 - **Progress in the Production of Sugar-Beets and Beet-Seed in Russia.**

Fortschritte auf dem Gebiete des Rüben- und Rübensamenbaues Russlands. — *Blätter für Zuckerrübenbau*, XXIX Jahrgang, No. 13, pp. 201-207. Berlin, 15. Juli 1912.

Contribution to the technique of seed production. — The area devoted to the cultivation of beets for seed increases yearly in Russia (1), for the seeds there produced are distinguished by possesing a great capacity of germination.

For the increase of the selected seeds, the special system is adopted of an intermediate generation between the selected parent plants and the commercial seed (German " Stecklinge "). This system is carried out according to the fundamental principles laid down in the countries of Western Europe. In order to ascertain whether these principles hold also for the climatic and soil conditions prevailing in Russia, the Union of the Russian Sugar Industry has intrusted to Mr. S. L. Frankfurt, the director of the experiment fields, the task of making a special study of the question. The results of these experiments, which lasted for some years, have been collected and arranged by the writer in the form of a table and prove, almost without exception, that the closer the beets are planted, the larger is the seed yield on a given area.

The relation between the distance of the young beets from one another and the size of their roots. — In order to obtain from selected seed as many seed-beets as possible, there is a tendency in singling to leave the plants as close together in the rows as practicable, *viz.* from 1 3/8 to 3 1/2 inches apart. But, by this method the seeds are always so stunted and small, that the yield for unit of the cultivated area is diminished. As also the size of the roots of the seed-plants is in strict relation to the distance between them, these two questions were studied at the same time.

The above-mentioned table shows, that the less the distance left between the plants, the larger is the seed yield of a given area, but the productivity of the seed-beets is correspondingly decreased ; in other words, the same number of seed-beets planted at larger intervals bear more seed.

(1) The following are the figures for the agricultural year 1908-1909 : Area under beets, 1 374 400 acres ; sugar factories, 277 ; raw sugar produced in 1908-1909, 1 242 300 tons ; production of beets per acre, 12 900 lbs ; raw sugar extracted from 100 lbs. of roots, 14.00 lbs. ; raw sugar per acre, 1808 lbs. On account of the favourable climatic conditions in Russia during 1910 and 1911, the sugar production rose to 2 066 000 and 1 994 000 tons. From 1 1/2 to 2 tons of seed are obtained, of which the cost of production does not as a rule, exceed 2*d.* per lb. (EMILE SAILLARD, Enquête sur la culture de la Betterave à Sucre en Russie. — *Ministe de l'Agric., Direction de l'Agric., Bulletin mensuel de l'Office de Renseignements agricoles*, XIème Année, No. 5, pp. 610-625. Paris, mai 1912). (*Ed.*).

The question now arises as to whether it is well to plant large seed-beets further apart than small ones. From the experimental data obtained it is evident that with the usual distance adopted in Russia, 28 × 28 in., the different size of the roots has no noticeable effect on the seed production. This effect was more marked where the seed beets which had been singled out in four experiment fields to distances of 1 3/4, 3½, 5 ¼ and 7 inches were transplanted to 28 × 28 in. at Ladyzenka (Government of Kiev): the results were:

Distance apart of young plants (in.) . .	1 3/4	3½	5¼	7
Crop of seed in following year (cwt. per acre)	12 3/4	14	13¼	14 1/8

Although the experimental results cannot be applied generally to the whole of Russia, they clearly show that the size of the root of the beet has not much influence upon the seed yield; so that the practice of increasing the number of seed plants by singling lightly, resulting in a large number of plants of small size is justified from the standpoint of obtaining a large quantity of seed.

As regards the best distance to be left between the single plants, they must not be placed too close to one another, both on account of the cost of the plants, and because the amount of seed produced by a single individual increases in proportion to the space it is allowed. The number of plants required for one acre at 22 × 22 in. is about 13 000; at 28 × 28 in. only 8 000. This saving in costly plants with the wide planting is not nearly made up by the small increase in the seed yield with close planting.

Dividing the roots. — To increase the supply of seed-beets, recourse is had to dividing the roots. In a series of experiments (from 1905 to 1908) large halved roots were planted parallel to small whole ones. During the last two years care was taken that the large half-roots should weigh the same as the small whole ones. The experimental results show that in the first two years, the difference (excess with small whole roots) was much more noticeable then in the last two. The effect of halving the roots upon their development and upon seed formation was studied at the same time: it is evident that, even if halving the roots diminishes in some degree their development and the seed production, it is, nevertheless, a paying practice, especially as regards the large roots, which thereby are caused to produce almost double the usual amount of seed.

Topping the roots. — In Russia the view largely obtains, that topping the roots (by a straight or V-shaped cut) in such a way as to remove the apical buds, prevents the principal shoot from growing, and the seed-plant develops a more bushy form, and the yield is increased. The results of experiments on this subject show, that topping often not only does not increase the amount of seed produced, but even diminishes it. More

seed is obtained in years when the harvest is large. By removing the apical buds, the growth of the seed plants is checked, owing to which the formation and maturation of the stems is hindered. In dry seasons, the seed-beets have a tendency to ripen late and this danger has an intimate relation with the retarding of the maturation process. This explains why, in years when much seed is produced, that is to say, in the absence of unseasonable ripening, the removal of the apical buds does not give rise to such unsatisfactory results as occur in years when the ripening conditions are unsatisfactory. Another experiment has proved that topping hinders the growing-out of the plants and increases the number of failures.

Time of planting. — The earlier the plants are put in the ground, the sooner they ripen, and the larger is the production of seed.

Spring work and planting methods. — The experimental results, show that the relation between the seed production, the preliminary preparation of the soil, and the methods of planting varies according to the season. In 1909, in which year the soil did not become caked, breaking up the ground was not efficacious and no difference could be noticed whether transplanting was done with spade or dibble. In 1908, the ground formed a hard crust in the spring, and the use of a cultivator and spade-planting caused a perceptible increase in the seed harvest. The work following upon the planting had no effect upon the seed crop. In the countries of Western Europe, which are characterized by a more abundant rainfall, the seed beets are moulded up to protect them from excessive damp. But the conditions of soil and climate which prevail in Russia render this practice unadvisable, as it might make the ground too dry. Experimental results, which are given in a tabular form, show that moulding up the roots has no influence on their size.

Manuring. — Phosphatic manure alone (applied under each root) gave an increase in yield of seed in almost every case. Nitrate of soda alone and potash salts used alone were of little use. Superphosphate with nitrate gives usually better results than superphosphate with potash salts. A complete manuring gives better results than only one or two compounds. The results of the manuring experiments are in accordance with previous data concerning the manuring of beets and cereals and show that the black soils need phosphoric acid especially. While in the countries of Western Europe, the most important manures for seed-beets are nitrogenous ones, in Russia, on account of the climatic and soil conditions of the country, phosphatic fertilizers are indispensable.

In cases where nitrate has no effect, or a negative one (even though the soil has shown itself susceptible to nitrogenous manure), it causes an increased development of the vegetative organs, which hinders the ripening of the seed and, eventually, the latter matures out of season.

Applying the manure under each root proves to be more efficacious than broadcasting it, when an equal amount of superphosphate is used.

In general, these experiments show that the principles governing the production of seed-beets in the west of Europe are not applicable without modification to Russia, where the climate and soil are very different.

1296 - **Oil Seeds *(Telfairia pedata, Lophira* sp. Ground nuts, *Hydnocarpus anthelminticus*, Soy Beans, Hemp, *Camellia Sasanqua, Butyrospermum Parkii)* examined at the Imperial Institute, London.** OIL CROPS

1*. Oil Seeds of *Telfairia pedata*. 2* *Lophira* Oil Seeds from W. Africa. 3* Oils and Oil-seeds from Hong-Kong. 4* Tea-Seed Oil and Tea-Seed Cake. 5* Shea Nuts and Shea Butter. — *Bulletin of the Imperial Institute*, Vol. X, No. 2, pp. 223-235, 281-292. London, July 1912.

1. *Oil-Seeds of Telfairia pedata.* — The plant *T. pedata* (Cucurbitaceae) is indigenous to E. Africa, Zanzibar and Pemba. The kernels of its seeds are stated to be used by natives both as food-stuff and as a source of edible oil. According to an analysis published by Gilbert (see Sadebeck: *Die Kulturgewächse der deutschen Kolonien und ihre Erzeugnisse*, Jena, 1899, p. 245) the seeds contain:

Moisture	6.56
Ash	2.04
Oil	36.02
Protein	19.63
Woody fibre	7.30
Nitrogen-free extract	28.45

A sample of the seeds from Zanzibar was recently examined at the Imperial Institute. They were flat, irregularly circular in shape and about 1¼ to 1½ inch thick. The single seeds averaged 4.9 grams in weight.

The seeds consisted approximately of 11 per cent. fibrous husk, 38 per cent. shell, and 51 per cent. kernel. A previous investigator has recorded 7.33 per cent. of fibrous husk, and 60 per cent. of shell and kernel. The kernels yielded 56.9 per cent. of viscous slightly reddish-brown oil (as against 60 to 64 per cent. of previous observers).

Examination of the oil gave the following results:

	Sample from Zanzibar	Figures previously recorded by various observers
Specific gravity at $\frac{15^\circ\text{ C.}}{15^\circ\text{ C.}}$	0.919	0.915 to 0.9185
Acid value (*)	2 6	0.34 » 2.44
Saponification value (*)	196	186.5 » 202
Iodine value, *per cent*	89	84.2 » 100.7

(*) Milligrams of potassium hydroxide required per gram of oil.

The oil belongs to the class of non-drying oils, and would be suitable for soap manufacture. An intensely bitter substance contained in the husk renders the oil unfit for human food and the oil cake for cattle. This could be avoided by unhusking the seeds, but so far no machine suitable for the work is known. Samples of seeds of *T. pedata* and *T. occidentalis* are from time to time sent to Europe, but not in commercial quantities.

2.* *Lophira oil-seeds from West Africa.* — The kernels of *Lophira alata* came from seed collected in the Karene district of the Sierra Leone Protectorate; those of *L. procera* (« Kaku ») from the Gold Coast. The first gave 40 per cent. of solid fat, the second (containing 8.7 per cent of moisture) 55.3 per cent. On analysis the following results were obtained:

	Fat of *L. alata*		Fat of *L. procera*
	Seeds from Sierra Leone	Previous samples examined at the Imperial Institute	
Specific gravity at $\frac{100° C.}{15° C.}$	0.859	—	0.859
» » $\frac{40° C.}{40° C.}$	—	0.9016 to 0.9044	—
Acid value *	26 0	25 9 to 48.0	11.6
Saponification value *	188.9	180.7 to 183.3	190
Iodine value per cent.	68.0	69.8 to 72.5	60
Titer test (solidifying point of fatty acids)	45° C.	47.5° to 49° C.	—
Unsaponifiable matter per cent	2.5 (approx.)	0.5 to 0.86	0.8

* Milligrams of potash for 1 gram of fat.

L. alata fat is suitable for soap-making but not for edible purposes owing to its taste and high acid value, as well as to the cost of sufficiently refining it. It was valued at about £30 to £31 per ton in Liverpool (November 1911).

The cake, on account of its bitter and astringent taste, would be unsuitable for feeding purposes and could be used only as a manure. It was valued at about £3 per ton. It contains:

Moisture	8.50 per cent
Ash	4.48 »
Nitrogen	1.87 »
Potash K_2O	1.91 »
Lime CaO	0.18 »
Magnesia MgO	0.30 »
Phosphoric acid P_2O_5	0.51 »

The decorticated seeds were valued at about £10 per ton c. i. f. Liverpool (October 1911).

The fat and the cake of *L. procera* could be utilised in the same way. As the cake contains only 3½ per cent. of ammonia it is valued at about 35*s.* per ton as manure.

3.* *Oils and Seeds from Hong Kong.* — The results of the analyses of four samples of ground nut oil are given. The oils were received respectively from the Hoifung district of Kwantung Province; from Ling-Chan, an island within the Hong Kong New Territories; from Shanghai; and from Chinkiang.

Another oil called "Tai-Fung Chi Yan", and said to be produced in Kwangsi Province, resembles in composition the oil of *Hydrocarpus anthelminticus* ("Lukrabo" oil). It is suitable only for soap-making. Hydrocarpus oils were recently imported to Europe. They were used for the preparation of edible fats, and gave rise to several cases of poisoning.

Soy Beans. — Four samples of soy beans were examined. Like the preceding ones, they came from Hong Kong: Their yield and estimated price per ton were as follows: "White Beans" ("Pak tan") 18.1 per cent. of oil, price about £8 per ton; "Green Beans" ("Tsing Tan") 17.9 %, £ 17 17*s.* 6*d.* to £ 8 per ton; "Yellow Beans" 16.6 %, £ 7 15*s.* to £ 7 17*s.* 6*d.* per ton; "Black Beans", 15.1 %, £ 7 10*s.* to £ 7 15*s.* per ton. A sample of the finest quality Hong Kong soy bean oil was valued at £ 23 5*s.* per ton; its analysis yielded the following data:

Specific gravity at $\frac{15.5^\circ\ C.}{15.5^\circ\ C.}$. . .	0 924
Acid value	2.5
Saponification value	195.8
Iodine value, per cent	130.0

Hemp Seed. — Hemp seed from the same source yielded 28.2 % of oil (as against 30 % obtained from hemp seed of average commercial quality) and appeared to be of inferior quality to that imported from Manchuria.

4.* *Tea-seed oil and Tea-seed cake* (1).—Analyses of *Camellia Sasanqua* oil and cake from Hong Kong but imported thither from Wuchow, Kwangsi Province. In China the oil is used as an illuminant, and the cake as a substitute for soap as it contains 7 to 8 per cent. of saponin, too small a quantity to allow its being used as a substitute for quillaia bark (soap bark), but apparently enough to be of use in the preparation of vermicides for dressing lawns.

Oil:	Specific gravity at $\frac{15.5^\circ\ C.}{15.5^\circ\ C.}$	0.918
	Acid value	9.4
	Saponification value	193.4
	Iodine value, per cent	87.5

(1) See *B.* Jan. 1912, No. 115. *(Ed.).*

Cake :

Moisture	8.33 per cent	Fat	1.31 per cent
Crude proteins . . .	6.49 »	Starch etc . .	45.24 »
True proteins . . .	6.13 »	Fibre	37.43 »
Other nitrogenous substances	0.36 »	Ash	3.20 »

5.* *Shea Nuts and Shea Butter* (*Butyrospermum Parkii*) (1). — After some information on the first discovery of the tree by European travellers, and the introduction of its products into Europe, on its classification and botanical description, the author states that the shea-tree is found in French Guinea, Senegal, Upper Senegal and Niger ; the northern portions of the Ivory Coast, the Gold Coast and Togoland ; Northern Nigeria ; the Northern portions of Southern Nigeria, Kamerun and the French Congo ; the Bahr-el-Ghazal and Uganda. Almost all the material exported from West Africa comes from Northern and Southern Nigeria.

Exports from Southern Nigeria.

	Shea nuts		Shea butter	
	Tons	£	Tons	£
1908	3 967	35 612	320	5 637
1909	9 728	78 029	309	5 230
1910	4 464	43 510	340	6 804

Exports from Northern Nigeria.

1908	3 921	69 404	174	1 504
1909	9 086	90 857	109	2 188
1910	4 241	41 080	103	2 062

Of the above probably only a small proportion is exported in the shell.

Butyrospermum Parkii (var. *magnifolium* in the Sudan, Upper Senegal and Middle Niger; var. *Poissonii* in Dahomey, and var. *niloticum* in Bahr-el-Ghazal) has a hard wood which is employed by the natives for making pestles, mortars, and other implements. The fruits consist of an outer pulp, largely eaten by the natives, enclosing one or sometimes two or three nuts, about 1½ in. in length and 1 in. in diameter. On drying, the shell can be easily removed. The fresh fruit is composed of from 40 to 65 per cent. of pulp and 60 to 35 of fresh nuts, on average about 49 per cent. The fresh nuts yield about 57 per cent. of sun-dried nuts, or 39 per cent. of sun-dried kernels containing 5 to 6 per cent. of moisture and suitable for export. It thus appears that a native must gather nearly 5¼ tons of fruit in order to prepare 1 ton of kernels for export.

B. Parkii begins to bear fruit at from 12 to 15 years of age, reaching

(1) See *B.* Nov. 1910, p. 76; March 1911, No. 835 ; Aug.-Sept.-Oct. 1911, No. 2612. (*Ed.*).

maturity at about 30. In view of the enormous areas at present untouched, it seems hardly likely that the necessity for plantations will arise.

Yield. — The shea tree is notoriously irregular in yield of nuts; one tree has been known in some years to produce as many as 20 000 nuts or about 130 lb. of dry kernels. A machine for removing the pulp and the shells would be very useful.

Pests. — In certain seasons locusts attack the trees and prevent the formation of fruit over large areas. A large caterpillar also lives on the tree during the wet season, but it seems uncertain whether it does any damage. A small caterpillar, *Mussidia nigrivenella*, Rag., also lives on the nuts. Two kinds of *Ficus* are found growing on the trees and sometimes cause their destruction. Some *Loranthaceae* also grow upon the branches. Most of the damage to shea trees however probably arises from bush fires.

Trade in shea kernels and butter. — The prices are very variable. In Liverpool the current prices in May 1912 were £ 11 per ton for kernels and £ 29 per ton for butter.

Shea butter. — A native can prepare about 8 lb. of butter in a day, but more than half the fat is not extracted and gets wasted. After the removal of the shells the kernels are roasted in a kind of earth-built oven with the object of rendering them easier to grind and also of coagulating the latex and preventing it from being extracted with the fat; the roasted kernels are then crushed in a mortar or between two flat stones; the crushed

	Specific gravity $\frac{99^\circ C}{15^\circ C}$	Saponification value	Iodine value	Insoluble fatty acids	Unsaponifiable matter	Titer test 0° C	Percentage of fat in kernels
Shea butter from:							
Lagos	0.862	179.0	58.0	96.5	1.7	52.0	—
Gold Coast 1	—	184.6	56.0	—	—	51.8	—
» » 2	—	183.0	56.7	—	—	—	—
Bahr-el-Ghazal	—	181.7	54.0	—	—	53.2	—
Fat extracted from kernels from:							
Southern Nigeria 1	0.869	181.5	62.0	91.2	6.3	—	48.6
» » 2	0.867	182.8	57.7	94.6	7.0	—	52.4
» » 3	—	181.2	59.4	—	—	—	41.4
» » 4	—	180.2	55.8	—	—	—	46.2
Bahr-el-Ghazal	0.859	184.0	62.9	91.9	4.3	—	47.2

mass is boiled with water, the fat being skimmed off as it rises to the top. From the examination of samples of the fat at the Imperial Institute the figures on the previous page were obtained.

The fat is used largely by the natives of West Africa for food, and to some extent as a burning oil. In Europe the high melting point of the fat and of the fatty acids renders it specially suited for the manufacture of candles and, in admixture with other oils, for soap-making. The presence of unsaponifiable matter is a disadvantage, especially in the manufacture of edible fats. It could be used as a lubricant after removal of the acids.

Shea Nut Cake. — The following is the percentage composition of this cake :

Moisture	Ash	Fat	Proteins	Carbo-hydrates	Crude fibre
—	—	—	—	—	—
7.85	5.50	20.3	11.13	48.54	6.68

In the above analysis the shea nut cake is richer in oil than is usual. Shea nut cake possesses a bitter and unpleasant taste and probably contains saponin in common with other sapotaceous oil-seed cakes, whilst from the small amount of proteins it would not be very nutritious. Feeding trials carried out at the " École Nationale d'Agriculture de Grignon " showed that the cake did not prove poisonous to sheep in quantities up to about 1 lb. per diem, but that the animals in some cases refused to eat it at all, and in other cases a long period elapsed before they became accustomed to it.

RUBBER, GUM AND RESIN PLANTS

1297 – A New Rubber-producing Plant.

OLSON-SEFFER, RUNAL. Una nueva planta productora de Caucho. — *Revista de Agricultura*, Anno VIII, No. 2, pp. 52-55. Santo Domingo, Mes de Mayo, 1912.

The Author, Chief of the Botanical Section of the " Secretaria del Fomento " in Mexico, has published in the review " La Hacienda " the following particulars with regard to a new rubber plant, which is especially interesting as it is a tree growing in hilly country in dry and stony soils, not a very common thing for rubber plants and one which must be well borne in mind. This tree, called by the natives " Cacaloxochitl," and according to Geo. Wannag having a high percentage of rubber, belongs to the genus *Plumeria* of the family Apocynaceæ (1). All the known species of this family in Madagascar produce a latex-like juice ; but *Plumeria rubra* is the only one known up to now as a producer of rubber in sufficient

(1) Jumelle cites *Plumeria articulata* Wahl as a white balata of Central America and regards its latex as valueless. Cf. H. JUMELLE. - *Les plantes à Caoutchouc et à Gutta*, pp. 498-499 (Paris, 1903).

quantity to be worth extracting (1). The trunk, from 6½ to 16 feet high, has a girth of from 8 to 24 inches ; the bark is rough and of a light grey colour ; the leaves are opposite ; the flowers are white and large ; the root is used by the natives as a purgative. *Plumeria* is common in many regions of Mexico and Central America ; it grows under the best conditions in sandy, stony and rocky soils on the mountains at a height ranging from 1000 to 4000 feet, in dry regions where there is an average yearly rainfall between 30 and 50 inches.

Plumeria abounds in the territories of Morelos and Oaxaca, and in the districts surrounding the territory of Vera Cruz ; it is likewise found in Michoacau, Guerrero and some parts of Puebla.

This tree is easily reproduced by slips ; in the Botanical Station of Tezonapa, four weeks after a branch had been planted, new leaflets were observed. This method of multiplication, which has been found superior to that by seeds, enabled the tree in three years to attain a sufficient size to undergo the treatment for extracting the rubber. As it is a plant capable of producing in considerable quantity a good quality of rubber, further investigations will be made ; nevertheless from the experiments carried out up to now at the Botanical Station of Tezonapa some indications are already available as to the best method of tapping. The ordinary system of incisions would not give such good results as in other cases for the same reasons as appply to the Palo amarillo; the young parts of the plant contain a quantity of rubber in excess of that of the trunk. Therefore lopping off the heads of the plant is advisable and extraction must be made from the young branches thus pruned. Experience shows that this pruning, far from imperilling the life of the tree, improves its conditions of vegetation when carried out with care, and increases the growth of the branches.

Geo. Wannag obtained from the young branches 4 % of rubber of a quality not inferior to the best rubber on the market.

When from 30 to 75 trees per acre are found this species attains to some commercial importance.

The chemist at the station of Tezonapa is said to have found, on analysing the coagulate of the latex, the following composition :

Resin	21.9 %
Moisture	15.7 %
Rubber	25.5 %

(1) The red balata is, according to some writers, *Mimusops Balata* Gaertn. which Herbert asserts is the one called "purgo" by the natives of Venezuela, where on tapping it yields good rubber. It is one of the most beautiful trees of the forests of the Guianas and of Venezuela, being confined to these regions and the island of Trinidad; it grows exclusively in mountainous, stony and ferruginous soils ; a dry season is extremely beneficial to it. Cf. H. JUMELLE, *Loc. cit.*, pp. 499-503. (*Ed.*).

1208 - **Jelutong** (1).

F. M. A propos du Jelutong. — *Journal d'Agriculture Tropicale*, 12e Année, No. 132, pp. 161-165. Paris, 30 juin 1912.

Some confusion prevails in the botanical identification of the plant which supplies Jelutong rubber. The "Hanjaloetong" and the "Pantoeng," to which this property is attributed, are said to be, the former *Dyera costulata* Hooker, and the latter *Dyera Lowii* Hook. fil.; but this latter is likewise said to be known as Jelutung in the west of Borneo and in Malacca. "Pantoeng," like "Hanjaloetong," grows in genuinely marshy soils; the last-named has a trunk which attains large dimensions and has broad buttress-roots; these roots are so light that they are used by the natives in place of cork.

"Pantoeng" is known in three verieties, white, black and red. The third, less rich in latex, grows more especially in mountainous soils; the two last are trees of those special marshes which are called "loeau" in Borneo. Their subsoil is peaty and the water is ruddy brown in hue: the type of vegetation is strange; almost all species have roots which emerge from the soil and project much above its level, afterwards sinking in again; the peaty subsoil is covered with decayed liana leaves and trunks. The "Pantoeng," adapted to these strange lands, attains imposing proportions, 6 ft. 6 in. in diameter and 100 to 170 feet in height. These trees are generally 200 to 300 yards apart, rarely less than 50 yards.

The extraction of the latex is carried out by the natives; each operator can deal with about fifty trees per day. He begins by removing with a special instrument, the "parang," four or six pieces of bark all round the tree at a height of 5 ft. The first liquid flowing out is of little value, but about 5 minutes later it thickens and remains adhering to the trunk. The native, having made similar incisions on 50 trees, returns and detaches with a wooden spatula the mass adhering to the wounds, which he collects in a wooden vessel, adding ⅓ of water to prevent over-rapid coagulation, afterwards carrying it away on his shoulders. Coagulation is produced by pouring the whole of the latex into cylindrical casks made of bark and adding three parts of water, a quarter of a pint of petroleum and an exceedingly small quantity of a special resinous substance; the whole is finally stirred for about two hours. On the following day the bottom of the cask, in which there is a hole covered with clay, is opened, the water is allowed to flow out and there remains dry the coagulated block, which, after being left for about 30 hours, is washed with hot water and smoothed on the surface with a bottle. The block weighs from 26 to 40 lbs., but it contains about one-third of its weight of water, retained during the operation of co-

(1) See *B.* Feb. 1911, No. 508; July 1911, No. 2191 and Aug.-Sept.-Oct. 1911, No. 2742. (*Ed.*).

INSTITUT INTERNATIONAL D'AGRICULTURE

Bureau des Renseignements Agricoles et des Maladies des Plantes

(Bulletin, III^e Année, N° 9, Septembre 1912. - XII + 224 pp. in-16 ; 130 notices)

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agulation. It is, however, the rule to require that it should not contain more water than 2⅓ times the weight of rubber.

The trees, after having been subjected once to this treatment, are submitted to the same operation during the following days, the incisions being gradually extended upwards and then in width, until the bark has been removed over the whole trunk from ground level up to the height to which the native can reach with his "parang."

Trees of medium size can be tapped for a year, others often longer, but the removal of the bark done without thought for the injury caused to the cambium results in the tree being attacked by ants and by a worm, the "toemang"; it falls about two years after the first tapping, breaking off at 5 ft. from the ground. The fallen tree is treated in such a way as to extract the latex still found in all its parts.

1299 – **Use of Ammonia or Carbonate of Soda in Tapping Hevea.**

LUCAS, W.: Emploi de l'ammoniaque ou du carbonate de soude pour la saignée de l'Hevea. *Bulletin de l'Association des Planteurs de Caoutchouc*, Vol. IV, No. 6, pp. 123-124. Anvers, juin 1912.

The quantity of scrap formed by the coagulation of the latex on the trees being considerable, as compared with the quantity of rubber resulting from the coagulation of the latex in the works, the difference in price between these two qualities has led the Author to make various experiments with the object of reducing the quantity of scrap. The same applies to the "lump" or rubber resulting from the partial coagulation of latex in the cups or during transport, a coagulation due to heat and jolting.

The coagulation of the latex being promoted in an acid medium, the question was to keep the latex in a sufficiently alkaline medium to prevent partial coagulation taking place too quickly, whilst avoiding a degree of alkalinity which would too greatly retard the subsequent coagulation at the factory and require the use of too great an excess of acid. After various trials carried out on 150 trees, the Author decided in favour of using the following solution: 30 cc. of ammonia (17 % of gaseous ammonia) and 970 cc. of water. Each coolie received 1 litre (1 ¾ pint) of this solution per 150 trees, representing an average of 332 incisions. The trees were tapped daily with half-herringbone cuts. The experiments were continued during a month on more than 5 000 trees, one half of which were tapped as usual, that is to say using ordinary water to facilitate the flow of the latex, whilst for the other half, water with ammonia added was employed. Under these conditions the quantity of scrap coming from the trees for which water alone was used was 50 % greater than that from the trees for which ammonia was employed. The method of use of the ammoniacal solution is as follows: the coolie is provided with a piece of rotang about 8 in. long and ⅕ in. in diameter, one end of which he beats so as to crush

the fibres and turn it into a sort of brush. With this brush the coolie wets the vertical outlet channel and then makes 1, 2 or 3 incisions according to the tree, so as to have the half-herringbone on his right, if it has been made from left to right, or on his left if made from right to left. He then takes away a part of the liquid with his brush, applies it against the tree, a little above the top of the herringbone, and presses out the liquid with his finger. This is done 2 or 3 times in succession for each such cut. Taking up his position behind the tree, the coolie can very well guide the outflow of the liquid, which follows the flow of latex, without anything dripping on the tree. This entire operation occupies an exceedingly short space of time.

With regard to the lump, it can be reduced by adding 1.6 cc. of ammonia (17 % of ammonia gas) per litre of water in the vessels into which the latex flows. The quantity, which was about 240 grams of dry lump for 150 trees, was reduced by one half by the use of the ammoniacal solution on the tree alone and to 3 to 14 gr. when this solution was used on the tree and in the cups.

As regards coagulation, 0.7 cc. of acetic acid (98 % strength) was used per litre of diluted latex when ammonia was not employed ; under these conditions coagulation began straightway upon the addition of the acetic acid and the coagulum was removed on the expiry of 20 minutes. By using the ammoniacal solution on the tree alone, the quantity of acetic acid employed was the same as that indicated above, but coagulation took place more slowly and the coagulum was only taken away after 30 minutes. As a consequence of using the ammoniacal solution on the tree and in the cups, the quantity of acetic acid needed was 1.3 cc. per litre of dilute latex and the coagulum was also removed after 30 minutes. From the foregoing it results that scrap and lump are substantially reduced by employing ammonia, and that consequently the quantity of rubber prepared in the factory is increased by the same amount. Besides this, as the ammonia retards the formation of scrap (which chokes up the laticiferous vessels and contributes to stopping the flow of latex), it cannot be otherwise than favourable to the yield.

The Author found that ammonia possesses in addition the following advantages :

1. The straining of the latex is much easier than if water alone is used, in which case the meshes of the strainer are quickly choked up, which necessitates frequent cleaning.

2. The impurities passing through the strainer fall more easily to the bottom of the vessel in which the coagulation is carried out, while they remain in suspension if coagulation has already begun.

In consequence of the comparatively high price of ammonia, the Au-

thor made experiments with carbonate of soda, which gave results just as good, but do not yet allow of indicating figures and must be continued on a basis of comparison with ammonia.

1300 – **Tobacco Industry of Ceylon.** VARIOUS CROPS

Bulletin of the Imperial Institute, Vol. X, No. 2. pp. 187-205. London, July 1912.

Tobacco has long been grown in parts of Ceylon, the chief producing centres at present being Jaffna, Chilaw, Batticaloa and Trincomalee, Kurunegala, and Teldeniya. The two kinds of tobacco grown by the natives, *viz.* a kind for chewing and leaf used locally for cigars, are unsuited for export to Europe. The former finds a market chiefly at Travancore, in Southern India, but the exports of chewing tobacco are rapidly diminishing, and owing to the high duty now proposed it seems possible that the Indian market will eventually be practically closed to Ceylon tobacco. If the tobacco industry is to be maintained other markets must be found; hence the recent endeavours to produce a tobacco suited to European consumption.

The general report on the Ceylon tobacco industry has been published recently by the Ceylon Government and is summarised below.

The approximate total area under tobacco in Ceylon is 15 000 acres, of which over 7 000 acres are in the Northern Province, 3 000 in the North Western, 3 000 in the Eastern and 1 500 in the Central Provinces. On average one acre will bear 4 000 plants, yielding about 40 000 leaves.

The cultivation of tobacco in the Northern Province has been carried on from time immemorial. The crop is grown chiefly on what are called " garden lands " and sometimes in rice fields immediately after the harvest. At present the area devoted to chewing tobacco largely exceeds that occupied by cigar tobacco, a state of affairs which may be reversed. The aim should be to abandon a large part of those fields where tobacco is grown at present and to start tobacco culture in other localities better suited to cigar and cigarette tobaccos, growing Turkish and Virginian cigarette tobaccos in rather poor soils with little rainfall; in richer soils with more regular rainfall, experiments should be carried out with cigar tobaccos following the Cuban and Porto-Rican methods.

The native methods of culture consist of: careful preparation of the soil, abundant manuring, especially rich in nitrogen and including green manuring, cattle dung, goat or sheep folding, and green leaves; two and a half months between the time of sowing and transplanting to the fields, irrigation every other day, wide planting, low topping and late harvesting (about 4 months after planting). The method of curing " smoking tobacco " is the following: Drying the plants first in the sun and then hanging them in the air in the shade for three days; the leaves are then cut off and buried for 3 days in heaps of cow dung or in the ground, when they are

taken out and " smoked " for 3 days, after which they are piled in heaps and pressed and again smoked.

The curing of " chewing tobacco " is carried out as follows: The leaves are cut and left in a heap for one to three days, then exposed to the air in the shade for a day or two ; they are then smoked two or three times at intervals of 5 or 6 days, next hung in the shade in the open and when quite dry put in heaps under pressure. The poor quality of Ceylon tobacco is partly due to these methods of curing.

Samples of tobacco were forwarded to the Imperial Institute by the Director of the Royal Botanic Gardens, Peradeniya. The leaves had an average length of 19 to 20 in. and a breadth of 7 to 9 in. They burned moderately well, but the smoke was pungent. On analysis they gave the following results :

Moisture	16.5	per cent
Nicotine	4.9	»
Ash (crude)	14.7	»
Ash (free from sand)	13.9	»
Potash (in sand-free ash) . .	18.99	»

From the opinions of experts to whom the tobacco was submitted it appears that the soil and climate of Ceylon are suitable for the production of a good tobacco fit for the European market. Experiments are needed to determine the type and the conditions under which it should be grown.

Exports of Tobacco from Ceylon

	Manufactured Tobacco		Unmanufactured Tobacco	
	Quantity lb.	Value £	Quantity lb.	Value £
1906	—	—	4 390 497	61 041
1907	110	5 ½	4 425 619	61 920
1908	252	20	4 075 075	54 094
1909	469	32	6 077 221	82 521
1910	761	34	1 543 021	24 919

Various kinds of cigar tobaccos, *e. g.* Sumatra, Java, Cuba, etc. were cultivated at Peradeniya twenty-five years ago, but the cultivation was subsequently abandoned as the planters had no confidence in its proving profitable. In 1910 a series of experiments was instituted by the Ceylon Agricultural Society at Maha Iluppallama with Sumatra and Java tobaccos, and samples of the produce were examined by the Imperial Institute with the following results, to which are added those referring to tobaccos recently cultivated at Trincomalee:

	Samples from Maha Iluppallama				Samples from Trincomalee	
	Sumatra N° 1 %	Sumatra N° 2 %	Java N° 2 %	Java N° 3 %	December crop, 1909 %	December crop, 1910 %
Moisture	17 5	15.1	12.5	13.2	9.8	15.1
Nicotine	1.8	1.7	1.1	1.8	3.0	1.4
Nitrogen	1.5	3.1	2.0	2.7	3.2	3.3
Ash	16.6	12.6	18.0	15.3	15.6	12.5
Composition of ash:						
Lime	30.7	35.2	30.4	34.1	27.7	33.2
Potash	21.7	19.2	20.3	11.5	16.0	20.1
Soda	0.2	0.4	0.3	1.1	2.4	2.5
Sulphates (expressed as SO_3)	2.4	4.0	4.1	8.4	1.8	4.7
Chlorides (» » Cl)	16.1	8.9	10.9	9.1	7.3	6.5
Burning quality	Poor	Poor	Moderate	Bad	Moderate	Poor
Nature of Ash	White flaky	White flaky	Grey flaky	Almost black	Dark with grey patches	Black

Some of these samples contained more moisture than is permissible in tobacco intended for the English market, namely about 14 per cent. Nicotine and nitrogen are in normal quantities. The percentage of ash is low (probably due to poor soil), and in the ash the potash content (to which the burning quality is roughly proportional) is also low, compared with the amount of sulphates and chlorides. The defect probably arises from the soil being rich in the latter salts or from the use of manures containing these constituents.

Other defects of these samples were their bad and uneven colours and bad grading, due no doubt to the absence of skilled and experienced labour.

The commercial valuations showed considerable variation for the same samples, as some of the experts considered the tobaccos for cigar purposes while others valued them as material for "cutting" into pipe tobacco. On the whole, from the foregoing, it appears that the prospects of tobacco growing and curing for exportation to Europe are not unpromising and experimental work should continue both with cigar tobacco and tobacco of the Virginian type.

1301 – **West African Cocoa.**

Bulletin of the Imperial Institute, Vol. X, No. 2, pp. 239-247. London, July 1912.

Some samples of cocoa beans from Serabu, Sierra Leone were examined at the Imperial Institute, London. They were found to be insufficiently fermented (one of the samples had been fermented for four days, another

for six); the flavour was mild and free from bitterness. They were valued at from 46*s.* to 54*s.* per cwt. at Liverpool, and thus represent a saleable quality of cocoa, but better prices would be obtained for similar beans if they were more thoroughly and uniformly fermented.

The cocoa industry of the Gold Coast is in a very flourishing condition, but the quality of the cocoa produced still leaves a good deal to be desired, and the Botanical and Agricultural Department of the Colony is conducting fermentation experiments.

In certain of the chief cocoa-producing countries it is the practice, after fermentation, to dust the beans over with finely powdered red clay. The clay adheres to the shell of the bean which is still moist and sticky. and then the beans are polished. This "claying" has the effect of improving the appearance of the beans, and is said to assist in preserving them against fungoid attack. An experiment on "claying" beans was carried out in the Gold Coast and two samples forwarded to the Imperial Institute for examination. The shells of the "clayed" sample contained 8.92 per cent. of moisture and yielded 20.50 per cent. of ash. For the shells of the "unclayed" sample, the figures were 10.08 and 7.41 respectively. The samples were submitted to manufacturing firms and brokers, and they all preferred the unclayed sample. The practice of claying does not appear to be advantageous: cocoa that is properly fermented keeps for a considerable time without deteriorating. If necessary artificial driers might be used.

In preparing cocoa beans for the market the beans and adherent pulp are placed in a vat or other receptacle to ferment, the temperature of the mass rising from 30° to 50° C. The germ of the bean is killed in this process, and at the same time the astringent matters in the fresh bean are destroyed to a great extent and the colour changes from a purplish hue to a rich brown. The chief object of this process is to kill the bean without injuring the enzymes, probably chiefly oxidases, which are stated to be the real means of reducing the bitterness and altering the colour, for which reason the beans are frequently turned to keep the temperature below 60° C.

Several new methods of bringing about these changes have been suggested. Dr. Fickendey, Victoria, Kamerun, has suggested that the beans should be subjected after removal of the pulp to change of temperature, either by heating them to 50° or 60° C. for 24 hours or by keeping them at a temperature of 0° to 1° C. for 3 hours. The cooling method was applied experimentally in Kamerun, and the results were favourably judged in Germany. The two Fickendey processes were experimented by the Agricultural Department in the Gold Coast in comparison with *a*) fermentation for eight days and then washing or not and drying in the sun, and *b*) simply washing and drying. The samples thus obtained were sent to the Imperial

Institute for examintation and submitted to brokers and cocoa manufacturers. The fermented cocoas were pronounced the best, the worst was the sample which had been only washed and dried, and those which had been heated or cooled occupied an intermediate position. The beans subjected to Fickendey's processes had undergone to some extent that change in colour and flavour caused by fermentation, thus supporting Fickendey's contention that fermentation may be dispensed with provided that other means are taken to kill the embryo without destroying the oxidising enzymes.

1302 – **Cultivation and Production of Kola Nuts on the Ivory Coast.**

La culture et la production du Colatier à la Côte d'Ivoire. *Bulletin de l'Office Colonial*, 5e Année, No. 54, pp. 205-208. Melun, juin 1912.

The Kola in the region of Adzopé is *Cola nitida* var. *rubra* of Chevalier, a tree producing nuts with two cotyledons, almost exclusively red. Their weight ranges from a minimum of 7 gr. (¼ oz.) to 60, 80 and even in exceptional cases 100 gr. (3½ oz.). These Adzopé nuts are said to have bad keeping qualities ; nevertheless they are no richer in water than the best, nor are they more readily attacked by insects. Possibly this defect pointed out by the Dioulas is due to early or late picking. It is only during the last two or three years that the natives have gathered these seeds, and they are still unaware of their precious qualities and value. The kola appears more common in the forest, in the part which has sprung up again after the abandonment of old cultivations. The principal fruit-bearing period in those parts is from December to February.

The Senegalese Dioulas who have bought the kola nuts in the region of the Attié (Adzopé) go to sell them on the coast. Those of Soudanese origin on the other hand convey their goods towards Dimbokra and Bonakè.

The visible production may be valued at about 3 tons, which must be regarded as a minimum. The villages of Adzopé, Moapé, Bonapé Akoupé and Bekofi have vast territories adapted for kola growing and this group of extensive and populous villages has now cut deeply into the primeval forest, which has almost completely disappeared. On this land methodical plantation will prove easy and will offer a sure returm.

In the district of Bougouanou the production is more considerable than in that of Adzopé. The quantity appears to be no less than 5 or 6 tons. Sowings of kola nut have already been made in the different villages and a total of 4400 nuts have been put into the ground by the natives under the guidance of a cultivation instructor. This is the first step in the direction of methodical reafforestation.

The district of Ouellé is of greater importance owing to the fact that in the northern part the natives of the tribe of N'gau carry on real cultiva-

tion of kola. The chief crop is secured in July and August, but in reality fruit formation continues to some extent throughout the year. In this region the kola begins to yield fruit about the seventh or eighth year, rarely in the third. Its productivity extends from 20 to 40 years. A full-grown kola can supply in an average year about 800 nuts. The average crop in this region is reckoned at from 40 to 50 tons.

1303 – Liquorice Growing in Moravia.

MITLACHER, W. La culture de la réglisse en Moravie. - *Pharm. Post*, XLV. p. 358, 1912. Abstract in *Journal de Pharmacie et Chimie*, 104e Année, No. 2, pp. 79-80. Paris, 16 juillet 1912.

Liquorice is cultivated in Moravia in the villages of Poppitz and Auerschitz, both near the city of Auspitz. The soil consists of tertiary and quaternary sandstone. The cultivation is carried on in loose soil on slopes with southern exposure, and alternating with vines. For planting recently cut suckers about 12 in. long are used; they are planted in the soil obliquely, to a depth of 12 in. and 20 in. apart. This is done early in April or else in the autumn. The crop is lifted after four years. Intercalary crops of legumes, maize, etc., may be secured. In lifting the crop the largest roots are taken, leaving sufficient in the ground to produce a second crop of the drug four years later. The roots are stripped and cut into pieces; the small pieces of less value are left as they are. A number of fresh and flexible roots are sold as "Easter rods" in Bohemia.

The cultivation of liquorice is generally remunerative, but the plant is subject to the attacks of a fungus (*Rhizoctonia violacea*) which destroys the root and renders the soil unserviceable for further liquorice growing.

MARKET GARDENING

1304 – The Horticultural Output.

The Gardeners' Chronicle, Vol. LII, No 1334, p. 50. London, July 20, 1912.

The following figures are taken from *The Agricultural Output* published by the Board of Agriculture. They relate to the year 1908 and to holdings over one acre in Great Britain.

Crops	Acreage	Quantities cwts	Values £	Yields per acre cwts
Apples	172 751	4 486 000	1 490 000	26
Pears	9 604	183 000	90 000	19
Cherries	11 868	176 000	194 000	15
Plums	15 683	715 000	357 000	46
Others and mixed .	40 391	812 000	406 000	—
Total orchard fruit	250 297	6 372 000	2 537 000	—

This total covers 27 433 acres of small fruit grown among the trees, and in addition 57 447 acres were occupied by small fruit alone, making the total for small fruit 84 880 acres including :

Crops	Acreage	Quantities	Values £	Yields per acre
Strawberries	28 815	829 000	1 036 000	29
Raspberries	9 323	206 000	309 000	22
Black currants	5 939	56 000	84 000	9
Red and white currants	3 761	68 000	69 000	18
Gooseberries	16 541	347 000	208 000	21
Others and mixed	20 501	252 000	252 000	—
Total small fruit	84 880	1 758 000	1 958 000	—
Totals : all fruit	307 744	8 130 000	4 495 000	—

The figures for apples and pears include fruit used for making cider and perry.

The total area in Great Britain devoted to flowers and shrubs is put at a little over 4 000 acres and the value of the products at £121 000.

If holdings of one acre or less had been included in the estimates, the quantities would have been much greater. The yields in 1908 were below the average. It must further be noted that the yields of small fruits grown under trees are included with those grown alone ; again, no attempt has been made to distinguish the area of young fruit trees not yet in bearing, so that the yields per acre given cannot be regarded as trustworthy.

1305 – **The Cultivation of Early Produce in Brittany.**

LE CORRE, J. La Culture des Primeurs en Bretagne. - *La Vie Agricole et Rurale*, [illegible] 34, pp. 207-210. Paris, 20 juillet 1912.

The cultivation of early produce enjoys very advantageous conditions, both economic and cultural, in Brittany, and rarely will these conditions be found combined elsewhere : exceptionally mild climate, soil not too dry nor too wet, manures and soil-improvers from the sea close at hand, abundance of labour and proximity to England.

Climate. — The proximity of the sea reduces the extremes of temperature and in a very large measure keeps off the spring frosts which are so fatal to early crops, so that wherever a promontory is found having a slop exposed to the south or east and sheltered from the north-west winds, the cultivation of early produce is possible. The market garden centres already in existence are therefore situated on the promontories which advance farthest into the sea : Quiberon, Loctudy, Plougastel - Daoulas, Roscoff, Lézardrieux, Saint-Malo - Cancale.

Soil. — The vegetable-growing regions of the coasts of Brittany belong to different geological formations ; in the peninsula of Penmarch

the soil is of granitic origin with a variable proportion of sand and clay; at Saint-Brieuc it is plateau clay, in very thick beds; round Saint-Malo, Pre-Cambrian schists or *Calymene* schists. But the calcareous soil-improvers, especially "tangue" (calcareous sand from the shore), and the abundance of farmyard manure and seaweed, have completely modified the original composition of these soils from both the physical and chemical points of view; they are loams, permeable and highly fertile.

Manures. — The use of composts is the rule: to farmyard manure, "tangue," and seaweed is added as much sewage and horse dung as possible. These composts are spread over the soil before the winter and ploughed in. In the spring, about 8 cwt. per acre of a complete manure called "guano" is sown; it contains approximately 4 to 5 % of ammoniacal nitrogen, 10 to 12 % of soluble phosphoric acid and 4 to 5 % of potash; it is applied before the last working, or in the case of potatoes in the split ridges.

Economic position. — Labour is abundant. Ports of shipment are numerous, but unfortunately being shallow they are inaccessible to vessels of medium and large tonnage. The port of Saint-Malo alone is sufficiently well served by the South-Western Railway Co. The latter Company alone forwards one half of the early produce of Brittany, which, via Southampton, reaches the London market in 24 hours. In 1911, a comparatively poor year, this company shipped from St. Malo to Southampton the following:

Potatoes	26 500 tons
Tomatoes	494 ,,
Cauliflowers	3 464 ,,
Radishes	29 ,,
Apples	15 000 ,,
Pears	2 600 ,,
Gooseberries	10 ,,
Black Currants	365 ,,
Cherries	98 ,,

Growing of early produce. — For the past fifteen years the growing of early produce has undergone considerable extension in Brittany, chiefly round Saint-Malo. The cultivation of potatoes carried on since 1890 in the neighbourhood of Paramé, has become of great importance of late years. The exports to England, which were only 19 500 tons in 1900, reached 37 200 tons in 1905, representing a sum of 7 to 8 million francs. At the present time there are forwarded yearly, from May to July, about 60 000 tons of early potatoes from the port of Saint-Malo, via Southampton, Hull and Liverpool. The variety most grown about Saint-Malo is the Fluke Géante: this variety alone occupies nine-tenths of the area; the tubers are yellow in colour with almost white flesh.

Side by side with the market garden crops : potatoes, tomatoes, strawberries, onions, cauliflowers, artichokes, etc., there are at Paramé glass-houses where enormous quantities of flowers etc. are grown for cutting: carnations, arums, smilax, asparagus, etc. The Mariette glass-houses are celebrated for their pineapples and those of Grande Baronnie for *Physalis* or Chinese lantern, the strange fruit of which is chiefly exported to America.

1306 – **Fennel-Growing in the Bosco Eliseo (Comacchio, Italy).**

CIRELLI ETTORE : La coltivazione dei finocchi nel Bosco Eliseo (Comacchio). - *L'Italia Agricola*, Anno XLIX, No. 13, pp. 303-305. Piacenza, 15 luglio 1912.

The cultivation of sweet fennel (*Fœniculum dulce* D. C.) which has been carried on in the territory of " Bosco Eliseo " for some hundreds of years, in times past only supplied the needs of the population of Comacchio. The multiplication of means of communication and the daily growing demand have in a brief space of time intensified and extended its production. According to the latest land survey records (1908) the market gardens of Comacchio have an area of 100 acres, two-thirds of which are under fennel. Sowing is carried out in seed beds in August on plots thoroughly worked and manured. Transplanting takes place gradually between October and December. The plants are ready by April and May ; the fennel sown in January and planted out permanently in March is lifted in June and July. For the former a total production of 1 500 000 roots may be reckoned : for the latter 40 000 to 50 000. Three or four days before lifting, the roots are pressed down lightly so as to get bleached. They are grown along with maize or melons, and they alternate with tomatoes and kidney beans. The maize gives a crop of 16 to 20 cwt. per acre, the tomatoes 7 to 8 tons ; the yield of melons is exceedingly variable according to the character of the season. Adverse influences, both of a parasitic and a non-parasitic character, at times work havoc with the crop. Attacks of chlorosis are not infrequent. Several years ago there was a severe infection of mildew, due to *Plasmopara nivea*.

The market garden cultivation at Comacchio is already intensive ; one acre of land supplies about 24 000 fennel roots, which fetch 1*s*. 9*d*. to 2 *s*. per 100 at the place of production.

1307 – The Trade in Flowers in Russia.

1*. Importations des fleurs, plantes et graines à Moscou. *Minist. de l'Agric., Direction de l'Agric., Bulletin mensuel des Renseignements Agricoles*, XIème Année, No. 5, pp. 644-646. Paris, mai 1912.

2*. BALDWIN v. RAMULT, STANISLAUS. Der belgische Blumenhandel mit Russland. *Mitteilungen der Fachberichterstatter des k. k. Ackerbauministeriums and Spezialberichte auf dem Gebiete des internationalen Holzhandels*, Nr, 12, pp. 95-96. Wien, 1912

The exportation of flowers from Belgium keeps on increasing. The statistics published by the Ministry of Finance give the following figures :

Exports of Flowers from Belgium.

Destination	Weight in lbs.		Value in £	
	Belgian and foreign goods: general trade	Belgian and naturalised goods: special trade	Belgian and foreign	Belgian and naturalised
Argentine	37 716	19 753	981	674
Austria-Hungary	1 020 917	1 019 742	13 551	13 499
Bremen	185 096	129 399	11 529	2 121
Canada	89 762	60 283	976	812
Denmark	543 438	327 482	28 304	3 619
France	7 098 162	6 550 563	89 753	82 113
Germany	13 242 104	11 633 077	250 152	130 772
Great Britain	2 787 040	2 701 720	66 345	63 484
Hamburg	203 884	103 105	10 871	1 225
Holland	2 665 674	2 327 226	52 232	34 282
Ireland	40 038	40 038	954	954
Italy	257 052	256 931	6 235	6 230
Lübeck	35 571	32 985	1 174	503
Luxemburg	407 267	373 241	2 742	2 120
Norway	138 645	131 948	2 898	2 322
Russia	328 840	287 938	6 337	4 584
Spain	103 413	102 177	2 035	1 997
Sweden	835 993	830 118	18 042	17 857
Switzerland	878 509	813 643	11 038	10 089
United States	3 984 186	3 820 578	83 721	79 995
Other countries	109 831	70 578	2 589	2 151
Total	34 993 138	31 632 525	662 460	461 405

In the last few years the exports of flowers from Belgium to Russia, which takes great quantities of flowers, plants and seeds, have shown a marked tendency to increase, thus competing with those of other countries.

Russian gardening does not supply anything like enough for the needs of the country, and the climate and insufficiency of means of communication are also hindrances to its development. All the same the development of the system of railways joining north and south is a distinct encouragement to flower-growing in the parts where it is possible. In the Caucasus and the Black Sea coast districts, growing of rose bushes, laurels and palms is already undertaken.

The flower trade has developed enormously in Russia. Competition between the exporting countries has considerably lowered prices, but they are still sufficient for the exporters to make good profits. The yearly importation of plants and seeds into Russia reaches about £1 400 000. Moscow imports about £80 000 worth of flowers every year, chiefly from Belgium, Holland, France and Germany; Belgium supplies nearly all the palms (*Phœnix*), valued at £4000 a year, though they are actually grown in the south of France. The hyacinths and tulips supplied by Holland are likewise largely of French origin. The following plants are both grown in and exported from Belgium: rhododendrons, sold at 2*s.* 6*d.* each, of which Moscow takes 20 to 25 thousand a year; laurels, value about £800; rose bushes (also sent by Luxemburg and Germany); about 1000 herbaceous plants, at 2*d.* a piece; and about 10 000 trees at 1*s.* 1*d.* each.

Cut flowers are imported into Russia to the value of about £60 000 a year.

First class roses are sent from Paris, Brussels, and Berlin; lilacs from Paris and Berlin: these come in pots, at 2*s.* 1*d.*, and Moscow takes 20 000 pots a year; lilies-of-the-valley are from Germany and Holland and eftch 35*s.* a thousand.

Seeds of all sorts imported into Moscow have a value of £20 000; they come chiefly from Paris and Germany; Belgium also sends a good quantity, but they are of foreign origin.

A great lot of ivy and other climbing plants are grown in Belgium and sent to Russia; ivy is imported into Russia to the value of £4000 a year.

The Dresden gardeners have started market gardens in Russia(1).

(1) See also: *Ministero di Agricoltura, Industria e Commercio, Ispettorato dell'Industria e del Commercio, Ufficio d'Informazioni commerciali.* Il commercio dei fiori freschi recisi in Europa, pp. VI + 221. Roma, 1908.

FRUIT-GROWING

1308 – **Production of the Spanish Vineyards and Oliveyards in 1911.**

Estadistica de la producción de uva, mosto, aceituna y aceite en el año 1911 y comparación de la del'ultimo quinquenio. — *Dirección general de Comercio, Industria y Trabajo. Boletin oficial de Comercio, Industria y Trabajo*, Año I, No. 2, pp. 137-146. Madrid, Junio 1912.

The following figures for 1911 have been communicated to the " Junta consultiva agronomica " by the agricultural specialists of the " Servicio agronomico provincial :"

Production af Spanish Vineyards.

REGIONS	Total yield of grapes: cwt.	Total yield of must: Imp. gallons	Area of vineyards: acres
Central, or New Castile	9 070 900	52 143 009	460 800
La Mancha and Estremadura	8 280 500	54 217 000	534 000
Old Castile	4 809 400	33 572 000	260 600 (1)
Aragon and Rioja	3 250 900	22 266 000	232 400
Leon	1 962 600	14 191 000	146 900
Galicia and Asturias	3 042 600	20 088 000	71 670
Navarre and Vascongadas	731 860	4 988 000	38 820
Catalonia	7 524 590	51 982 000	535 600
Levante (East Coast)*	8 577 750	45 363 000	679 800
Eastern Andalusia*	3 012 250	4 469 000	110 200 (2)
Western Andalusia	2 440 750	14 952 000	87 900
Balearic Isles	233 780	1 555 000	15 600
Canaries*	126 025	649 000	13 440
Total	53 064 000	324 435 000	3 187 750

(1) This includes 2250 acres of American vines in the province of Burgos, of which 1915 are not yet in bearing and the rest yielded 3.2 cwt. per acre.

(2) Out of 13 830 acres in the province of Almeria, 12 400 are grown on the pergola system, producing 1 234 000 cwt. of grapes for export, an average of 5 tons per acre.

* In the provinces of Valencia, Alicante, Granada and Malaga and in the Canaries, 1 720 000 cwt. of grapes were dried as raisins.

Production of Spanish Oliveyards

REGIONS	Total yield of olives: tons	Olives used for oil: tons	Total production of oil: tons	Area of oliveyards: acres
Central, or New Castile	77 828	77 064	14 054	211 500
La Mancha and Estremadura	148 236	145 420	28 432	(1) 388 400
Old Castile	30 793	30 742	6 340	19 050
Aragon and Rioja	131 732	131 585	25 889	149 800
Leon	3 679	3 512	641	10 375
Galicia and Asturias	118	118	24	445
Navarre and Vascongadas	4 005	3 887	832	23 050
Catalonia	204 783	204 595	39 693	451 600
Levante (East Coast)	135 498	130 535	25 641	269 500
Eastern Andalusia	451 702	448 300	92 581	756 800
Western Andalusia	948 077	867 014	170 528	1 222 000
Balearic Isles	47 995	47 515	10 462	64 870
Canaries	—	—	—	—
Total	2 184 448	2 090 286	415 118	3 567 000

(1) The area in the provinces of Ciudad Real and Carcéres has been considerably increased by new plantations.

1309 – Exportation of Grapes from Almeria.

GUILLY, José LOPEZ. La exportación uvera en Almeria. - *Dirección general de Comercio Industria y Trabajo, Boletín oficial de Comercio, Industria y Trabajo.* Año I, No. 2, pp. 189-192. Madrid, Junio, 1912.

The Author, President of the " Camara Oficial de Comercio, Industria y Navegación de Almeria " supplies the following data :

Costs of cultivation, sulphur, sulphate of copper and manures for the production of 100 lbs. of fruit 3*s.* 6*d.* to 6*s.* 3*d.*
Gathering, cleaning, sorting and packing for each barrel of 48 ½ lbs. 4¼*d.*
Transport of each barrel from the zone of production on board . . . 4 3/4*d.* to 1*s.* 0*d.*

On the average two million barrels are used a year, of which two-thirds are of Galician and Portuguese pine, and one-third of New Orleans oak.

Packing uses up 2 325 700 bushels of cork sawdust produced in Andalusia, Estramadura and Catalonia from virgin cork (the product of the first stripping) and with parings from the manufacture of corks. The price of each barrel complete, including sawdust, is 2 *s.* for pine and 2*s.* 4½*d.* for oak.

Transport tariff :

To all points of England, per ton of 25 barrels	£ 1 plus 10 %
To Hamburg, per 25 barrels	25*s.* plus 10 %
,, increased, by trans-shipment, for Bremen, by	6*s.* to 7*s.*
To New York and Boston direct, per 25 barrels	£ 2 plus 10 %
To all ports of theBaltic, per 25 barrels	35*s.* to £ 2
To Rio de Janeiro, Santos and Buenos Ayres, per barrel	4*s.*

The grapes are transported to America by fast steamers of the lines Cyp Fabre y Compania, Anchor, Austro-American, Cunard, Lloyd Italiano, Sicula Americana, White Star, Lloyd Sabaudo and others, and to the other markets by almost all European lines, principally English and very few Spanish.

Exportation.

Liverpool	533 436	barrels
London	309 388	,,
Glasgow	125 379	,,
Hull	64 837	,,
Newcastle	31 349	,,
Bristol	29 542	,,
Cardiff	22 004	,,
Manchester	11 772	,,
Hamburg	341 179	,,
Bremen	30 387	,,
Amsterdam	12 577	,,
Baltic	11 882	,,
Antwerp	3 727	,,
New York	808 717	,,
Boston	10 127	,,
Philadelphia	1 710	,,
Baltimore	358	,,
Toronto	189	,,
Santos	7 209	,,
Rio de Janeiro	4 560	,,
Buenos Ayres	4 927	,,
Havana	3 896	,,
Other destinations	11 423	,,
Total	2 380 575	,,

Exportation is almost completely in the hands of Spanish and English commission agents, who receive the goods on arrival and effect their sale

by public auction. In addition to the costs of unloading, docks, storage, etc., the agents charge 5 % for brokerage, commission and guarantee, they being responsible for repayments and for the advances on account of expenses of crop and transport, and in most cases allowing the growers advances some months before harvest, mostly at the rate of 6 %.

The prices obtained by Almeria grapes have been going down recently owing to the competition of other grapes.

Those generally secured at public auctions during the last 5 years are as follows (per barrel):

England	4s. to £ 1,	average 8s.
Germany	6 to 22 marks,	„ 9 to 11 marks
United States	$ 1 to 7	„ $ 3.

When from these prices all expenses are deducted from vintage to sale, and for the United States a high customs duty of ½ dollar per barrel, there remains for the grower, says the Author, a very small margin of profit, which sometimes is converted into a loss. It is hence necessary to improve the conditions of production. For this purpose the Author requires: supply of water and the construction of carriage roads in the province of Almeria; the imposition of a reasonable duty on the exportation of virgin cork and cork waste; the reduction of customs duty in the importing countries.

The production of Almeria grapes forms the staple industry of 40 villages; its trade produces a movement in wages of £ 50 000 to workmen manufacturing the packages, and £8 000 per day for workmen in connection with shipment.

1310 – The Coconut and its Cultivation and Uses.

1*. The Coconut and Its Commercial Uses. - *Bulletin of the Imperial Institute*, Vol. X, No. 1, pp. 76-94, April 1912; No. 2, pp. 264-281, July 1912.

2*. Coconut Number. - *The Philippine Agricultural Review*, Vol. V, No. 5. pp. 243-286. Manila, May 1912.

3*. Cost of Working Coconuts. - *Tropical Life*, Vol. VIII, No. 7, p. 126. London, July 1912.

4*. Coconuts. *The Journal of the Jamaica Agricultural Society*, Vol. XVI, No. 3, pp. 149-150. Kingston, March 1912.

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I. Production and varieties.

The coconut palm is found growing naturally on most of the islands and coastal regions of the tropics, but it is also extensively cultivated.

In Ceylon 1035 863 acres were, in 1909, under coconuts and in 1910 the exports of coir and manufactures amounted to £197 458, of copra £846 515, of coconut oil £ 1 155 083 and of coconuts £ 458 312. The Straits Settlements exported, in 1910, £ 2 150 161 worth of copra and the Federated Malay States £139 326 worth, the produce of 130 300 acres. The same year Java exported upwards of 203 000 tons. In the Philippines there are probably 40 000 000 coconut trees; in 1910 120 000 tons of copra, worth $ 10 630 000 (£2 184 250), were exported; in 1911 143 000 tons, worth $ 12 500 000 (£2 570 000). In 1910 the copra exported from the Philippines amounted to about 27 % of the total world production (450 000 tons). The Fiji Islands exported in 1909 13 007 tons of copra; the Tonga Isles a value of £233 866.

Before the great hurricane of 1903 the output of Jamaica was over 20 000 000 nuts; it then dropped to less than half the number; during the last eight years, however, the number shipped has been steadily increasing and the outlook now is that within a few years the production will be enormous. In 1910, 16 102 acres were under coconuts. Cuba exported in 1910, 3 000 000 coconuts. British Guiana, where the trees occupy 12 000 acres, exported in 1911, 1 038 000 nuts; Honduras in 1910, 4 871 321 nuts. The British East African Protectorate exported in 1910-1911, £30 608 worth of copra; Zanzibar, in 1910, £219 527; Mauritius, £9 464 worth of coconut oil; and the value of coconuts and products derived from them in the Seychelles amounted to £57 922, while vast plantations have been commenced in German East Africa.

There are many varieties of the type species that differ in habit of growth, in the yield and in the size, shape and colour of the fruit. The coconut can grow up to the 25th degree North or South latitude, but it rarely ripens fruit in the extreme limits of this region. In Guatemala it is found up to 2600 feet above sea level. De Candolle believed that it was indigenous to the Indian Archipelago and the theory that ocean currents played an important part in dispersing the seed over wide areas is known. Other authorities favour an American origin and Cook (*Bulletin of the United States National Museum*, 1901, 7, 257; 1919, 14, 271) supports the hypothesis with strong arguments, among which the fact that of the 30 species(1)

(1) The *Index Kewensis* and its *Supplementa* (*primum*, *secundum* and *tertium*) record the following 83 species (synonyms omitted): - *acaulis*, Brazil; *acrocomioides*, Braz.; *amadelpha*, Paraguay; *amara*, W. Indies; *apaensis*, Parag.; *Arechavaletana*, Uruguay; *arenicola*, Parag.; *argentea*, New Granada; *australis*, Parag.; *Barbosii*, Braz.; *Blumenaui*, Hab.?; *Bon-*

of the genus Cocos, *C. nucifera* is the only one found growing naturally in the eastern as well as in the western hemisphere.

There are about 25 forms and varieties of the species *Cocos nucifera*; of these not more than 10 are sufficiently common to be worthy of mention as economic varieties. The best variety appears to be the Pemba (Zanzibar) for its high percentage of meat. The "Guinaring" or "Ivory" with pale yellowish white fruit, the "Kalimbahim" having the interior of the husk rose-coloured, the dwarf or "Dahili" or "Mangipud" and the giant nuts of Lingayen and San Ramon are Philippine varieties.

The edible sweet husk nut "Taguanum" is found in the Philippines and in India. The Macapumó of the Philippines is rather a sport or freak than a distinct variety. Its remarkable character consists in the cavity being more or less completely filled with "meat." About twenty "named varieties" are known in Malaya.

A green fruit, the total weight of which is about 6 3/4 lb., has the following percentages of component parts: Husk 30.6, shell 10.0, fresh kernel 29.4, water 30.0.

II. Cultivation.

Climate. — An average mean temperature of about 80° F., with little variation throughout the year, is perhaps the most suitable. An average annual rainfall of from 60 to 80 in. is advantageous, but as low a rainfall as 40 in., evenly distributed throughout the year, is found sufficient when the palm is growing on fertile, moisture-retaining soils. If less than 40 in. is received artificial irrigation becomes necessary. On poor sandy soils a rainfall of not less than 70 in. is essential.

Soil. — The following types of soils are suitable for coconut cultivation and are named in descending order of merit: Alluvial flats; sandy loams

neti, Hab.?; *botryophora*, Braz.; *Butaei*, Hab.?; *butyracea*, S. Am.; *campestris*, Braz.; *campicola*, Parag.; *campylospatha*, Parag.; *capitata*, Braz.; *catechucarpa*, Urug.; *Chavisiana*, Braz.; *Chiragua*, Trop. Am.; *Cognauxiana*, Parag.; *comosa*, Braz.; *coronata*, Braz.; *crispa*, Cuba; *Datil*, Argentine; *Drudei*, Trop. Am.; *Dyerana*, Parag.; *eriospatha*, Braz.; *flexuosa*, Braz.; *frigida*, Braz.; *Gaertneri*, Hab.?; *Glazioviana*, Braz.; *gramnifolia*, Braz.; *Guacuyule*, Mexico; *Hassleriana*, Parag.; *Inajai*, Braz.; *insignis*, Braz.; *Kotchoubeyi*, Braz.; *lapidea*, Braz.; *leiospatha*, Braz.; *lilliputiana*, Parag.; *mamillaris*, Philippines; *Martiana*, Braz.; *melanococca*, Hab.?; *Mikaniana*, Braz.; *Naja*, Trop. Am.; *Nolaia-assu*, Braz.; *nucifera*, Trop. Regions; *odorata*, Braz.; *oleracea*, Braz.; *Orbignyana*, Trop Am; *orinocensis*, Trop. Am.; *ovata*, Hab.?; *paraguayensis*, Parag.; *pernambucana*, Hab.?; *petraea*, Bolivia; *picrophylla*, Braz.; *pityrophylla*, Bolivia; *plumosa*, Braz.; *Procopiana*, Braz.; *pulposa*, Braz.; *quinquefaria*, Hort.; *regia*, Mexico; *Romanzoffiana*, Braz.; *Romanzoffiana-pulposa*, Urug.; *Sancona*, Braz.; *sapida*, Parag.; *schizophylla*, Braz.; *simplicifolia*, Hab.?; *speciosa*, Braz.; *stolonifera*, Urug.; *Syagrus*, Braz.; *sylvestris*, Hab.?; *Urbaniana*, Braz.; *Urucuru*, Braz.; *ventricosa*, Braz.; *Weddelliana*, Braz.; *Weddellii*, Braz.; *Wildemaniana*, Parag.; *Yatay*, Argentine; *Yurumaguas*, Peru. (*Ed.*).

with a good percentage of humus; brown loams; loamy gravels; clay loams.

Manuring. — Coconut palms on permeable fertile alluvial soil will grow vigorously without manure. Trees that are backward may be brought to a state of development uniform with the best by the use of a suitable manure, the following being recommended: castor cake, 4 lb.; steamed bones, 2 lb.; bone meal, 2 lb.; kainit, 3 lb.; chloride of potash, 1 lb.; mixed with about 24 lb. of cattle manure for each tree. After one or two crops have been removed from the trees the whole plantation should be manured, and this treatment should be continued every two years, a portion of the estate being treated annually. Dr. Bachofen has stated (*Revue des Cultures Coloniales* 1900, VI, 75) that a crop of 1000 nuts removes the following constituents from the soil: nitrogen, 8.6 lb.; phosphoric acid, 2.4 lb.; potash, 18.7 lb.; lime, 2.3 lb.; and salt, 21.4 lb. Trees in full bearing yield about 5000 to 6000 nuts per acre per annum. The manures usually used, besides the droppings of animals tethered to the trees to graze where grass has been allowed to grow under the palms, are: stable manure and refuse of all kinds; fish manure; bones and bone meal; castor cake. An easy method of restoring nitrogen to the soil is by green manuring with leguminous plants, among which the most suitable are: the pigeon pea (*Cajanus indicus*), the velvet bean (*Mucuna* sp.), the sensitive plant (*Mimosa pudica*), the ground nut (*Arachis hypogœa*), *Vigna Catjang*, sun hemp (*Crotalaria striata*) and *Tephrosia striata.*

Soils of a peaty nature and those rich in humus subject to flooding should receive frequent applications of lime. Dressings of from 10 to 12 bushels of lime per acre every alternate year give more satisfactory results than heavier dressings at longer intervals.

Planting. — It takes from seven to ten years for the coconut palm to reach the fruiting stage, after which it remains productive for upwards of eighty years. It is thus evident that the introduction of new varieties to replace inferior kinds is a costly undertaking; consequently the seed nuts from which it is proposed to raise trees for a plantation should be carefully selected, preferably among local varieties. Experiments conducted by the Department of Science and Agriculture of British Guiana show that imported varieties are liable to degenerate.

It is advisable to raise the young coconut palms in nurseries where at the end of ten to twelve months they are ready for transfer to the plantation. At least 50 per cent. more nuts should be planted in the nursery than the number of trees required, in order to allow for failures in germination and for a reserve of young plants with which to fill up the gaps that may occur.

Preparation of the land. — The preparation should commence with cutting down and burning all trees and vegetable matter with which the

land may be occupied. If the land is flat and subject to floods it should be drained; a slope of about 1 in 20 is a suitable gradient. Along the Malabar coast of India there are hundreds of acres of waste marshy lands that have been rendered suitable for coconuts by drainage. The method adopted is to form parallel trenches and ridges, according to the natural fall of the land, about 15 ft. apart from centre to centre; the soil taken from the trenches is used for the ridges which are usually 3 ft. high. Among modern planters the preference is given to distances of 30 ft. from plant to plant, because in permeable soil the roots of the fully developed palms spread horizontally to 18 or 20 feet from the base of the stem and about 6 feet in depth. Some planters transplant the seedlings to a nursery, and when 2½ or 3 years old they are lifted and transplanted to their permanent positions. As it is easier to water and to weed a nursery the trees grow rapidly; besides, this system admits of a further selection of the best plants. A slight shading is sometimes beneficial to the young plants and this may be afforded by growing another crop between the lines. Maize has been found useful for this purpose. Trees that are making satisfactory growth should not be manured, as this is liable to cause luxuriant growth and to retard the fruiting. Sometimes, until the palms commence to yield, catch crops are grown between the lines, but it is more advisable to grow only leguminous crops, which are partly grazed or turned in as green manure. As catch crops the most suitable are: sweet potatoes, cassava (with heavy manuring), ground nuts (which however are liable to attract animal pests), cotton, pineapples, taro and any of the pulses, the seeds of which may be harvested and the rest ploughed in. In modern practice it is found advisable to keep the whole surface of the plantation clean. The soil around the young plants is hoed or dug. A shallow ploughing is used to turn in the green manures and the periodical work of the disk plough is also advantageous.

Harvesting. — The average annual yield when trees are in full bearing varies from 50 to 70 nuts per tree, 80 to 100 in British Guiana, if good cultivation and manuring has been practised, but a much smaller yield from trees that are crowded or neglected. Individual trees have been known to produce from 150 to 200 nuts a year. Trees in bearing carry flowers and fruit all the year round. The commonest and best method of harvesting is for native gatherers to climb the trees and throw down the ripe nuts. To facilitate climbing, the trunks of the trees, which are for the most part inclined at an angle of about 45°, are notched. Only this method of hand-picking enables the gatherer to select the ripe nuts, and to remove the dead leaves, ant-nests and other insect pests. One coolie can harvest 400 nuts a day.

The removal of the outer fibrous husk, known as hulling, is effected

by striking the fruit on the pointed end of an iron bar or piece of hard wood fixed firmly in the ground.

It is estimated that one coolie can hull about 1000 nuts a day. On modern estates machines capable of decorticating 500 to 1000 nuts per hour are now employed, the husks being left in the best condition for the extraction of coir fibre.

Cost of forming a plantation. — The following is an estimate of the cost of opening up and bringing into bearing a coconut plantation of 500 acres in the Federated Malay States :

Expenditure.

First Year :	
Premium £175, quit rent £58 6*s.* 8*d.*, survey fees £58 6*s.* 8*d.*, felling £700, draining £700, seed £320 16*s.* 8*d.*, fencing £175, lining and planting £116 13*s.* 4*d.*, coolie lines £58 6*s.* 8*d.*, bungalow £140, tools £29 3*s.* 4*d.*, stationery £11 13*s.* 4*d.*, medical £175, weeding first six months at £17 10*s.* per acre, contingencies £116 13*s.* 4d., superintendence £420	£ 3 780 0 0
Second Year :	
Rent £58 6*s.* 8*d.*, weeding £700, superintendence £420, medical and contingencies £233 6*s.* 8*d.* . .	£ 1 411 13 4
Third Year :	
Ditto	£ 1 411 13 4
Fourth Year. :	
As above, but weeding only £420	£ 1 131 13 4
Fifth Year :	
Ditto £350	£ 1 061 13 4
Sixth Year :	
Rent £116 13*s.* 4*d.*, weeding £350, superintendence £420, picking £35, curing £131 16*s.* 8*d.*, transport £131 16*s.* 8*d.*	£ 1 185 6 8
Seventh Year :	
Ditto (1)	£ 1 726 13 4
Eighth Year :	
Ditto (1)	£ 2 018 6 8
Ninth Year. :	
Ditto (1)	£ 2 663 6 8
Grand total . . .	£15 970 6 8

(1) With extra cost of picking as the plantation comes into bearing.

Returns.

Sixth Year :	
10 nuts per tree = 67 tons 4 cwt. 3 lb. of copra at £15 13*s.* 7*d.* per ton	£ 1 054 13 4
Seventh Year :	
30 nuts per tree = 197 t. 18 cwt. 37 lb. of copra , .	£ 3 173 6 8
Eighth Year :	
40 nuts per tree = 267t. 17 cwt. 15 lb. of copra . .	£ 4 200 0 0
Ninth Year :	
50 nuts per tree = 336 t. 6 cwt. 21lb.	£ 5 273 6 8
Grand total . . .	£13 701 6 8

In Ceylon, on an estate in which the palms in partial and full bearing are about 80 per cent. and the young palms 20 per cent., the cost of production per ton of copra during the past season was as follows :

	£ *s.* *d.*
Picking, gathering and carting	5 7 ¼
Making copra	10 6
Control of borers, beetles and stem disease(1)	4 4 ½
Propping	7 9 ½
Transport (5*s.* 10*d.* by cart, 12*s.* by rail)	17 10 ½
Weeding	14 0 ¼
Roads and drains	1 0 3/4
Manuring (½ the estate each year)	2 0 10 ¼
Salaries, visiting, hospital, loss on rice, insurance, watchers, lines, wells, tools, carts and bulls etc. general charges	2 4 0 3/4
	£7 6 1 3/4

The average price for copra in Colombo for the past season was about £21 6*s.* 8*d.* (at present it is £22 18*s.* 8*d.*) per ton, so there remains a profit of about £14 0*s.* 6*d.* Of course brokerage and Colombo agency charges have to be deducted.

An estate planted with 60 to 65 trees to the acre and giving 60 nuts per tree, at the rate of 4 800 to 5 000 nuts to the ton, would give at least 150*s.* per acre profit, equal to £10 when in full bearing.

(1) Seventy-five different insects are known as injurious to coconut palms, but only five or six species are really serious pests. Among these the most destructive is the "rhinoceros" or "black coconut beetle" or "wang" (*Oryctes rhinoceros*), which is common in eastern countries and is probably distributed throughout the tropics where the coconut palm is grown. The insect called in Trinidad "rhinoceros beetle" is *Strategus anachoreta*. The stem bleeding disease is believed to be due to a fungus *Thielaviopsis paradoxa* (*T. ethaceticus*). On the parasites and diseases of the coconut see *B.* March 1912, No. 598. (*Ed.*).

III. Coconut Palm Products.

Native Uses. — In tropical countries where the palm is grown, nearly every part of the tree is utilised by the natives: thus the roots are used as an astringent in native medicine, or interwoven with fibres to form baskets. The trunk is used to form rafters and pillars of native buildings. The outer portion of the trunk, "porcupine wood," is used in Europe in marquetry work and cabinet making. The leaf-bud or "cabbage" is much appreciated as food. The leaves and fibres extracted from them are formed into mats, baskets, roof-coverings, fences, articles of clothing, etc. The flower spathes when dried are used as torches and are also twisted into ropes.

A favourite native drink, known as "toddy" in the East, is obtained from the inflorescence before the flowers expand. The young flower spathe is bound in several places; it is then bruised by beating daily for about ten to twenty days, after which a portion of the spathe is cut off and from the wound a quantity of liquor exudes and is collected in a vessel placed to receive it. This "bleeding" continues for about a month, yielding sometimes as much as six pints a day from a single tree. In a fresh state this liquid forms a pleasant beverage; when fermented the liquid becomes the highly intoxicating "palm wine" which on distillation yields about 25 per cent of the spirit known as "arrack." This spirit is produced in considerable quantities in Ceylon, the Malay Peninsula, etc. Palm wine, by acetic fermentation, gets converted into vinegar.

By evaporating toddy before fermentation has set in, palm sugar known as "jaggery" is obtained. An adult tree can yield about 3½ oz. of sugar per day during the greater part of the year, which amounts to about 16 cwt. per acre.

From the point of view of European trade the chief products of the coconut palm are: the nuts, copra, desiccated coconuts and coir.

Coir Fibre. — The best fibre is that derived from nuts that are gathered before they are quite ripe, and from the coast plantations. In the native process of preparing coir fibre the husks are hulled as described above and steeped in brackish water for from 7 to 18 months, then beaten to free the fibres from the corky material in which they are embedded. The fibre is then dried, cleaned, graded and baled. The modern methods consist in retting the husks in water heated by steam, passing them through a crushing machine, and then through an extractor or breaking-machine in which they are completely disintegrated. The fibre is then dried, freed from dust and debris in a "willowing" machine, and sorted, by combing, into grades. That known as "mat" fibre consists of the finer fibres used for spinning purposes, for mats or ropes; brush fibre or "bristle" is composed of the coarser fibres used for brushes and brooms. The short "curled"

fibre is used in upholstery as stuffing, and the dust or refuse as a manure and for gardening purposes. Ceylon " bristle " fibre is worth at present (June 1912) about £ 18 to £ 26 per ton, whilst " Ceylon fibre " fetches from £8 10*s.* to £14 per ton in the London market.

Desiccated coconuts. — Desiccated or shredded coconut is a comparatively recent product. The principal seat of the industry is in Ceylon, but the United States, the United Kingdom and Australia also manufacture desiccated coconut from imported nuts. The United Kingdom, the United States, Germany, Austria-Hungary, Belgium, France and Spain import large quantities of the product, which is used in confectionery as a substitute for almonds. The process of desiccation consists in removal of the hard shell and then of the brown skin of the kernels which are cut in halves and drained of their watery contents, passed through a machine which reduces them to strips, shreds or granular particles, and then dried in the sun or in special drying-rooms. Three nuts of average size yield about 1 lb. of desiccated coconut.

Copra. — The husked or unhulled nuts are cut in halves, and dried for some hours in the sun, after which the unhulled nuts are removed from the shells ; they are then further dried either in the sun or artificially. In order to avoid moulds, copra must not contain more than 5 per cent. of water. At the Paris Colonial garden, experiments were conducted successfully with sulphur dioxide as a preservative against moulds on copra. The number of nuts required for one ton of copra varies from 4 500 to 7 000. The price of copra in Liverpool was, in June 1912, from £ 24 12*s.* 6*d.* to £ 27 15*s.*

Coconut oil. — The natives of tropical countries prepare the oil by cutting the kernel in small pieces, exposing them to the sun and collecting the oil as it melts and runs off, or by pounding the kernels in mortars and crushing the paste. Another method employed consists in boiling the fresh kernels in water and skimming off the oil. Large quantities of oil are made by modern oil machinery. The chief grades of oil in commerce are, in descending order of merit : Cochin oil, Ceylon oil and Copra oil. The first two fetch at present (June 1912) in London about £ 44 10*s.* and £ 41 per ton respectively. Copra oil is prepared from copra by modern methods in Europe, in the United States, and also in Australia.

The fresh kernels contain only 30 to 40 per cent. of oil, whilst sun-dried copra contains about 50 per cent., kiln-dried 63 to 65 per cent, and hot-air-dried sometimes as much as 74 per cent. The copra is ground and expressed twice at 55° to 60° C. Coconut oil generally furnishes the following constants :

Specific gravity at . . .	15.5°C. / 15.5°C.	0.926
„ „	99°C. / 15.5°C.	0.873
Saponification value		231 to 268
Iodine value, *per cent.*		8.0 „ 9.5
Reichert-Meissl value		6.7 „ 7.5
Titer test, °C.		21.2 „ 25.2

Coconut oil is employed in very large quantities in the preparation of vegetable butters, the liquid glycerides ("coconut olein") which are removed being used in soap manufacture. The coconut "stearins" are employed as substitutes for cacao butter or for making candles. The following figures give an idea of the importance of the coconut oil industry:

Coconut oil imported into the United Kingdom in 1910:

Unrefined	539 686 cwt., worth	£1 013 629
Refined	500 219 „ „	1 136 736

Coconut oil exported from the United Kingdom in 1910:

Unrefined	73 137 cwts. worth	£126 710
Refined	228 109 „ „	430 663

Imports to Marseilles in 1910:

Copra	146 564 tons
Coconut oil	738 „

The residual cake (poonac) left after the expression of the oil, has the following composition:

Moisture	Ash	Fat	Proteins	Crude Fibre	Carbohydrates
9.01	5.65	9.20	21.19	11.91	43.04

Cake prepared by native methods will contain much more oil. The price of coconut cake is £ 8 3*s.* 9*s.* to £ 8 5*s.* per ton ex works, London (June 1912).

FORESTRY

1311 – **The Forests of Northern Russia.**

NERVLI, J. Liesa Sievera Evropeiskoi Rossii. — *Isvlessita Imperatorskago Liesnogo Instituta.* (Reports of the Imperial Forestry Institute). Vypusk XXII, pp. 221-242. S. Peterburg, 1912.

The forests of Northern Russia in the basins of the Petchora and the other rivers descending from the Ural mountains to the Arctic Sea are almost exclusively made up of conifers. They occupy extensive areas but never in fine, dense and continous formation, as the heedless work of de-

forestation carried out without judgment and method destroys the finest specimens and leaves brushwood in place of forest. The old and fine dense pine forests along the Petchora have now become a rarity, only the Siberian larch, owing to the low value of its wood, is still found in extensive stands. In the bottom of the valley and on the plains silver fir, spruce and birch mixed in various proportions predominate. As the slopes of the mountain are ascended, the silver firs increase in number, while the birches diminish and the Siberian larch appears, becoming finally predominant and extending to the limits of the forests.

Scots pine (*Pinus silvestris*) in pure stands is found on the sandy wet soils along the course of the Petchora with specimens aged 100 to 150 years and with an average height of 55 ft. and a diameter of 5¼ to 7 in. The timber of an acre may be estimated at about 7550 cub. ft. On other types of soil — clay, limestone and chalk — pine grows mixed with fir and larch. The soil best adapted for this species is supplied by the reddish clays which crop out along the Mesen ; here a tree 183 years old attained a height of 82 feet and a diameter of 15 in. breast high. In wet peaty soils pines grow slowly and imperfectly ; a tree 146 years old was hardly 30 ft. high and 7 in. in diameter.

Along the Petchora grows *Picea obovata*; in the other parts of the government of Archangel forms intermediate between *Picea obovata* and *P. excelsa* predominate. These spruces are the most widespread species in the Northern region, extending to the edge of the tundra, in which they still occur as more or less extensive isolated patches. This species thrives in all soils except peat, but prefers the reddish clays. Here some measurements showed an average of 65 feet height, 10 in. diameter and a mass of timber of 2900 cub. ft. per acre. The underwood is juniper and willows. On moist and sandy soils *Picea obovata* grows mixed with birches, yielding about 1150 cub. ft. of timber per acre with an average height of 45 feet.

Towards the Sablia mountains larch becomes more and more predominant, while firs and spruces occur in almost equal proportions. Here a tree of *Picea excelsa* 132 years old was found to be 55 feet high with a diameter of 11½ in. At the extreme northern limits of the zone of distribution of spruce two trees were measured : one of 97 years had a height of 33 feet and a diameter of 8.7 in., and one of 205 years a height of 36 feet and a diameter of 9 in.

Siberian larch (*Larix sibirica*) is found mixed with other species in clay, sand and chalk, pure stands occur along water-courses but not often. Generally it grows mixed with pine in the proportion of 7 to 3. In forests aged 150 to 200 years the amount of timber may be calculated at 1170 cub. ft. of larch and 365 cub. ft. of pine per acre. A tree felled for measurement showed a height of 66 feet and a diameter of 11½ in. In the soils

on the reddish clay it is associated with spruce in the proportion of 3 to 7. In specimens of 176 years a height of 91 feet and a diameter of 11 in. was found. Up the slopes of the Sablia mountains larch, as stated above, little by little takes the place of spruce and afterwards continues in unmixed stands to the farthest limit of forest. Measurements were carried out at two extreme points of this zone: (1) where larch appears, and (2) where it gives way to the alpine medows, bare patches and brushwood; in the first case a tree 225 years old was found to have a height of 57 ft. with a diameter of 13 in. and a timber content of 22 cub. ft., and in the second a tree of 137 years proved to be 41 ft. high and 9 1/8 in. in diameter. Here the bulk of timber in forests of 150 years does not exceed 570 cub. ft. per acre.

Abies sibirica mixed with spruce grows by preference on moist sands and loams. A specimen 123 years old showed a height of 54 ft., a diameter of 8 in. and a timber content of 8 3/4 cub. ft.

Pinus Cembra only grows along the banks of the Petchora, mixed with spruce, and does not extend to elevated localities. For a tree 138 years old there was found a height of 51 ft. and a diameter of 11 in.

Among birches two species are mentioned, *Betula verrucosa* which is rather rare and *B. pubescens* which is very common and found in pure stands in the Timan heights. Here the soil is composed of two layers: a superficial one 3½ in. thick and very rich in humus, and a lower one 4½ in. thick of coarse sand with clay partings. The surface cover is supplied by *Cladonia, Sphagnum, Hypnum* and *Polytrichum*. On a test plot the timber was found to be at the rate of 663 cub. ft. per acre with trees having a maximum height of 30 feet and a diameter of 5¼ in.

The following are the principal typical formations generally with their local names.

1. *Formation on peat soils.* — Very extensive; predominant species, pine; and as undergrowth, *Betula nana*. Deep peaty soil with surface cover of *Sphagnum, Ledum palustre, Vaccinium uliginosum, Andromeda polifolia*, etc.

2. *Wet "karenga."* — Pines in patches and clumps scattered over the tundra, here and there spruces and birches. The soil is made up of extremely poor sand and the plant cover of *Hypnum* and *Sphagnum*.

3. *"Rada."* — Extends all round the peat mosses. The soil is a peat poor in nutritive substances, and the plant cover is provided by *Sphagnum, Vaccinium*, etc. The predominating species are Scots pine and *Betula nana*.

4. *Woods of Scots Pine.* — On dry sandy soil, with loam subsoil in strips along river courses. Surface cover: *Cladonia*, sp., *Vaccinium Vitis-Idaea, Calluna vulgaris, Empetrum nigrum, Calamagrostis epigeios* and *Aira flexuosa*.

5. *Mixed formations of spruce, larch, poplar and birch.* — In sandy or loamy soil with clayey subsoil. The underwood and vegetable covering are formed by *Vaccinium Myrtillus, Rubus, Maianthemum bifolium, Lycopodium complanatum* and *Hypnum*. This type is encountered typically on river terraces.

6. *Marshy "Karenga."* — This is the type of transition into marsh. The soil is muddy peat with a covering of *Sphagnum*; spruces and birches grow promiscuously.

7. *"Parma."* — Mixed formations of spruce, cedar and birches on wet clayey soil, with the water-table quite near the surface. The plant cover is provided by *Sphagnum, Polytrichum* and *Angelica silvestris*; underwood of *Salix, Sorbus* and *Juniperus communis*.

8. Formations in which spruce predominates, mixed with larch, pine, birch and poplar; in the most varied soils.

9. Formations in which spruce predominates, mixed with poplar and alder, with underwood of willow and white alder: on clay and loam.

10. Between the Petchora and the Ural down to the shore of the Arctic Sea the tundra extends uniformly, broken only here and there by a few "islands" of spruce. The soil to which these patches of wood correspond is clayey; the underwood is of willows and various shrubs. Spruces suffer greatly from rot and their growth is slow; in specimens aged 200 to 250 years a diameter of 14¼ in. and a height of 32 ft. 9 in. to 34 ft. 6 in. were found.

1312 – Practical Forest Fire Conrol.

(1.) WEST COAST LUMBERMAN. Practical Forest Fire Control. — *Forestry Quarterly*, Vol. X, No. 2, pp. 290-292. Cambridge (Boston), Mass., 1912.

(2.) CANADIAN LUMBERMAN and WOODWORKER. Fire Patrol. — *Ib.*, pp. 292-293.

(3.) FISCHER, C. E. C. The Need of Fire Protection in the Tropics. — *The Indian Forester*, Vol. XXXVII, No. 5., pp. 191-221. Allahabad, May 1912.

(1) At the last conference of the Western Forestry and Conservation Association held in Pèrtland, Oregon, many points of practical interest in forest fire prevention and fighting were brought out. The value of the information may be judged from the fact that the men who made the statements have been directly interested in the fires for the past five or six years, and these men represented various organisations patrolling from 800 000 to several million acres each.

The number of acres allotted to each patrolman and the average cost per acre for protection during the season were shown as follows:

State	Acre per man	Cost per acre for season
		$
Washington	40 000	0.0125
Oregon	14 000	0.013
»	—	0.04
»	—	0.011
Idaho	40 000	0.011
»	11 000	—
»	—	0.011
» , dry season	20 000	—

CAUSES OF FIRES.

	Oregon			Idaho	
Lightning	6.6 %	4th	6 %		10 %
Campers, hunters, incendiary, etc.	25.6 %	3rd	22 %	60 %	
Slashings	21.0 %	2nd	14 %		90 %
Unknown	38.0 %	1st	20 %		
Engines, mills, etc.	8.8 %	5th	38 %	40 %	

Each column is a report of one association.

Consensus of opinion shows that slashings should be burned, but time of burning varies with region and varies with conditions in the same region, so there was general opposition to laws which compel burning during certain months.

Suggestions were made to hold woods foremen responsible for carelessness of men by charging up all damaged timber against cost of logging. Also to burn strips 50 to 100 feet wide between standing live timber and tract being cut.

Concerning patrol and fire fighting the following suggestions were made: Examinations for wardens, as to tactfulness, executive ability, woodmanship, knowledge of fire laws, etc. Chief warden should be centrally located while assistants have charge of outlying districts. System is absolutely necessary, no time to organize after a fire is started. Tools kept in locked boxes distributed to points of vantage and several keys left with people nearest to boxes. On railroad " speeder " patrol is very effcient. Where oil is used for fuel no fires were recorded and cost of oil is reported about the same as for coal operation. A satisfactory spark-arrester was not reported. 25 to 30 fires were reported as started from one electric storm within a few hours. The hunter is considered a more serious menace than either the settler or camper. It was suggested he ought not to be allowed in woods during dry season. Where pack animals are brought into use the mule is better than any horse. Concerning means of communication, No. 9 wire is recommended and wires to be attached to poles

not trees., Cost of telephone ranges from $28 to 50 per mile. The heliograph has proven unsatisfactory.

(2) The conclusions drawn by F. G. Davis, chairman of Fire Committee of Cœur d'Alene Timber Protective Association, after six years experience, are also interesting. Patrolmen are assigned districts varying from 20 000 to 60 000 acres, according to topography, fire danger and ease of travel. The equipment of each patrolman consists of light axe, short-handled shovel with round point, and small sized water bag. In settled country patrolmen work singly ; in unsettled, two camp together and work in opposite directions. Telephones are reported as best for getting early information. The class of labour employed should be best woodsmen and rivermen, for they are familiar with fire fighting tools and are less liable to become excited or nervous. It is impossible to get too many on a fire line. Care of fire after putting it under control is constant vigilance, burying smouldering roots, falling old stubs, and searching for and falling defective trees in heavy timber. The best methods of working men is by the hour rather than by the day ; no night work except watchmen, and not more than 10 hours a day. Night work is unsatisfactory and ineffective ; the ideal time to fight fire is from daylight to the middle of forenoon, beginning again at about 4 o'clock and working until dark. Wages should be a little higher than local wages but not high enough to suggest setting fire. Paying men at once in money is conducive of better help.

(3) There exists a great diversity in opinion, particularly among the Indian Empire Forest officers, regarding fire protection in the tropics. Mr. C. E. C. Fisher, Deputy Conservator of Forests in India, has made a comprehensive review of all that has been written on the subject. Taking into account all the evidence adduced, he arrives at the following chief conclusions : —

I. In all forests fire is harmful, both directly to the growing stock and indirectly by the removal of soil-covering, leading to desiccation, lack of aëration, crosion, loss of nitrogen, destruction of seeds, etc.

II. In certain forests, however, fire-protection unaided by other operations hinders the natural reproduction of the most valuable species, especially in the case of teak forests.

III. Improvement fellings and cleaning on a sufficient scale suffice to establish natural regeneration in the forests referred to.

IV. Fire protection is necessary in : —

a) forests required entirely or principally for the maintenance of the water-supply or for protection against erosion ;

b) forests where natural regeneration is secured or in which artificial regeneration is necessary or preferable.

V. Fire-protection to be really effective must be continuous.

LIVE-STOCK AND BREEDING

HYGIENE

1313 – Intracellular Ferments and Chronic Infection.

GRINIEW, D. P. Ferments intracellulaires et infection chronique. — *Archives des Sciences biologiques publiées par l'Institut Impérial de Médecine Expérimentale à St. Petersbourg*, Tome XVII, No. 2, pp. 177-218. St. Petersbourg, 1912.

The writer's experiments on the connection between infection and intracellular ferments were made on 15 guinea-pigs, which had been infected with tuberculosis and had died from that disease; and had for their object the determination of the quantitative variations that the lipolytic, catalytic, amylolytic, and nucleolytic ferments had undergone in the tissues of the diseased animals.

These experiments proved clearly the fact that intracellular ferments do not remain impassive in the struggle of the organism against the disease. In addition to the anatomo-pathologic lesions, the cells of the living organism react to the invasion of the pathogenetic agent by alterations in physico-chemical structures (*e. g.* increased water content) and by deviations, in one way or another, from their fermentation function.

According to the writer, these deviations show themselves, as a rule, in guinea pigs during the course of chronic tuberculosis, by a decrease in lipolytic power and in the perversion of the catalytic, amylolytic and nucleolytic properties of the tuberculous organs and tissues. The perversion consists in the amount of one or other of the three last ferments being increased in certain organs and decreased in others.

Organs and Tissues	Amount of Water	Lipase — Amount of KOH N/100	Catalase — Amount of O_2 liberated by H_2O_2	Amylase — Amount of starch broken up	Nuclease — Amount of P. liberated by sodium nucleate	Protease
Spleen	+ 4.5	— 42.3	+ 11.4	+ 2.4	— 59.3	Absent.
Heart	+ 3.3	— 39.5	+ 10.0	— 23.2	+ 61.2	
Kidneys	+ 8.5	— 51.0	— 17.7	— 11.0	— 20.0	
Brain	+ 1.9	— 57.0	+ 41.1	— 29.8	+ 0.6	
Lungs	+ 4.3	— 55.6	— 19.8	— 23.9	+ 114.5	
Liver	+ 9.9	— 59.8	— 13.2	+ 12.9	— 18.7	
Muscles	+ 7.7	— 50.5	+ 11.8	+ 40.0	— 73.5	
Bones	+ 6.1	— 60.0	— 42.6	+ 2.5	— 82.7	

The above table sums up the quantitative variations shown by the above-mentioned intracellular enzymes in guinea-pigs during the course of chronic tuberculosis.

This table shows, that all the chief internal organs, *viz.* kidneys, liver, lungs, manifest deviation on the minus rather than on the plus side and this, both relatively (as regards the other organs) and absolutely (as regards the ferment content under normal conditions).

All the ferments studied are present in the kidneys, in a less amount than the normal; it thus appears that the renal tissue which eliminates the toxic products of tubercle bacilli is the most injured and that changes in its chemical composition and its function occur owing to their influence.

The liver of which the secondary function is to allow all the blood to pass through it by which means the poisons contained in the latter are arrested, also in its turn becomes poorer in ferments.. The lungs suffer most in the diminution of lipase, amylase and catalase, — nuclease alone undergoes an augmentation due probably to the infiltration of the lungs by the leucocytes and to their greater richness in blood (caused by inflammation).

The spleen, which is usually regarded as the principal organ of defence, generally meets with the same fate as the other most important viscera ; its lipolytic and nucleolytic properties are reduced by about one half, its amylolytic property remains almost invariable, while the content of catalytic ferment is a little increased. It is thus evident, that tuberculosis in guinea-pigs entails a functional change (an alteration of the functions of the ferments in this case) in all the cells of the organism ; the vitality of the latter is then lessened. The conclusions to be drawn respecting the relation of the disease and the ferments are :

1. The intracellular enzymes depend closely upon the given state of the cellular protoplasm ; *vice-versa*, the divergence from the usual activity of the ferments allows of a more or less correct conclusion being arrived at as to the pathological condition of the cell.

2. There is a certain specific relation between the external agent which causes the protoplasm to act abnormally and the method of the cell's reaction. The lipolytic ferment is the one which, in chronic tuberculosis, causes the most serious and constant trouble ; the others are more inconstant in their action.

3. It appears that the intracellular ferments are closely connected with the defensive adaptations of the organism.

A bibliography of 43 works is appended.

ANATOMY AND PHYSIOLOGY

1314 – **Action of Bile on Proteids.**

ROGER, H. Action de la bile sur les matières protéiques. *Comptes Rendus Hebdomadaires des Séances de la Société de Biologie*, Tome LXXII, No. 24, pp. 1085-1887. Paris, 20 Juin 1912.

In carrying out researches on the action of bile upon the products deriving from the transformations of nitrogenous substances, the author examined also the action of bile upon albumen and its derivates, because the researches hitherto made in this respect had given contradictory results.

He was able to ascertain that bile precipitates proteids, (egg and blood albumen), from solutions when a few drops of acetic acid are added. But as acetic acid easily renders bile cloudy, a special process for preparing the bile-acetic acid reagent becomes necessary. To 100 cc. of ox gall, 6 cc. of glacial acetic acid and some animal charcoal are added ; the whole is then mixed and filtered and a further 10 cc. of acetic acid added.

This reagent added to albumen and peptonic solutions produces immediatly a precipitate ; if used in sufficient quantity it precipitates the whole of the above substances. The precipitate consists of a mixture of proteids, bile and the salts contained in the bile, as its weight is greater than the total weight of the proteids used.

The author summarizes the results in a table, and comes to the conclusion that Bertrand had already sustained, namely that " proteids are immediately precipitated from an acid solution by bile ".

FEEDS AND FEEDING

1315 – **Methods for Calculating the Influence of the Diminution in Milk-Yield due to Advance of the Lactation Period during Feeding Experiments, as applied in the Hohenheim Experiments.**

MORGEN A., BEGER, C., and FINGERLING, G. Darlegung der verschiedenen Arten der Depressionsberechnung bei Versuchen mit Milchtieren, durchgeführt an den Hohenheimer Versuchen. — *Die Landwirtschaftlichen Versuchsstationen*, Band LXXVII, Heft V & VI, pp 351-397. Berlin, 1912.

To determine the exact effect of various feeding-stuffs applied at different parts of the lactation period, a properly calculated allowance must be made for the normal diminution of milk-yield due to the advance of the lactation period.

The method generally employed has been to divide the difference between the mean daily yield of the first and last periods of experiment by the number of days elapsed between the middle of the initial period and the middle of the final period ; then to multiply this figure by the number of days between the middle of the initial period and the middle of the intermediate period, the result giving a " correction number " used in one of the two following ways :

I. The " correction number " is added to the mean daily milk-yield

of the intermediate period (trial feed period), and the yield thus corrected is compared with that in the initial period.

II. The "correction number" is subtracted from the mean daily milk-yield of the initial period, giving a value representing what the yield would have been during the intermiediate period with the ordinary food. This is then compared with the actual yield in the intermediate period (trial feed period).(1).

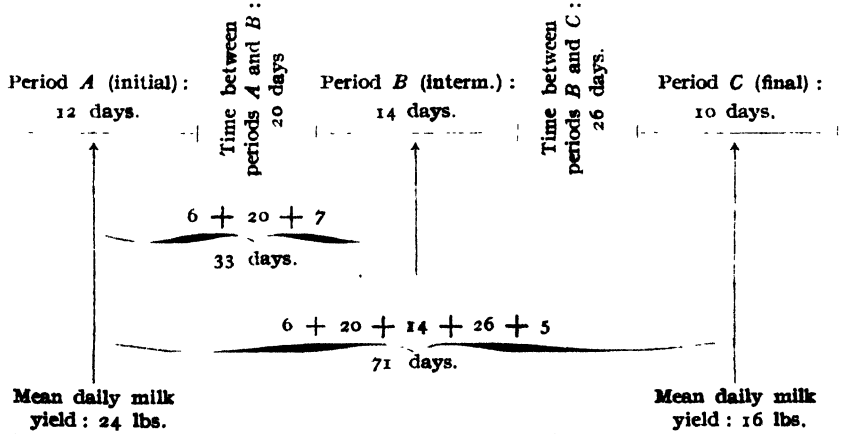
The difference between the yields of an intermediate period and the initial period comes out the same with either method, but it only gives an exact idea of the influence of the food under particular conditions; under other conditions the results obtained by the two methods are no longer the same.

In the first method, the milk-yield in an experimental period plus the correction-number is compared with the yield in the initial period: thus only a part of the figure compared — the actual milk-yield — has been influenced by the trial feed, the correction-number undergoing no such influence.

With the second method this error is eliminated, since the "correction-number" does not enter into the comparison.

For comparing the yields of two different experimental periods, exact results cannot be obtained either from the difference between the actual

(1) The following example prepared by us shows the method:



Diminution during course of experiment is $24 - 16 = 8$ lbs.

Daily diminution is $\frac{8}{71} = .112676$ lb.

Correction number for period *B* is thus $33 \times .112676 = 3.718$.

This number is either added to the mean daily milk-yield of period *B* (method I), or subtracted from that of period *A* (method II). (*Ed.*).

yield and the yield (calculated by either method) which would have been obtained with the normal ration, or from the proportional percentages deduced from the differences according to the first method. The deviations are not great if the yield of one intermediate period is compared with that of the initial period, but become considerable in the comparison of two intermediate periods with one another.

Supposing 100 to be the yield of the initial period, 40 that of the final period, four the number of periods (two intermediate), and 20 days the length of each period (without any intervals between the periods). The correction calculated as described above will be 20 for the second period and 30 for the third.

These figures can be arranged in the following table:

Periods	Milk-yield reduced to period I as 100	Correction	Change of yield as calculated by method II	Mean distance of periods from period I.
1	100	—	100	—
2	100	20	80	20 days
3	100	40	60	40 days
4	100	60	40	60 days

The following tables show the errors given by the calculation when the same foods are given in different periods:

		Foods	Milk-yield	Correction	Yield corrected according to method I.
A	1	Normal	100	—	100
	2	Amides	40	20	60
	3	Nitrogen-free substances . . .	15	40	55
	4	Normal	40	60	100
B	1	Normal	100	—	100
	2	Nitrogen-free substances . . .	20	20	40
	3	Amides	30	40	70
	4	Normal	40	60	100

In case *A*, in the intermediate periods (2 and 3) amides and carbohydrates are fed respectively giving 50 % and 25 % of the yield of the normal ration.

In case *B*, the same feeds are given but the periods of carbohydrates and amides are changed about.

If the yields in the two cases *A* and *B* are calculated according to methods I and II, and the proportional figures are also taken, the following results are obtained :

A. *Comparison between yields with normal ration and yields with amides*

RATION	Method I		Method II	
	A	*B*	*A*	*B*
Normal	Period 1 = 100	Per. 1 = 100	Per. 2 = 80(*)	Per. 3 = 60(*)
Amides	» 2 = 60	» 3 = 70	» 2 = 40	» 3 = 30
Difference with normal ration	+ 40	+ 30	+ 40	+ 30
Yield with amides as percentage of that with normal ration	60	70	50	50

(*) Figure obtained by subtracting correction-number from yield in period 1.

B. *Comparison between yields with normal ration and yields with carbohydrates.*

RATION	Method I		Method II	
	A	*B*	*A*	*B*
Normal	Per. 1 = 100	Per. 1 = 100	Per. 3 = 60(*)	Per. 2 = 80(*)
Carbohydrates	» 3 = 55	» 2 = 40	» 3 = 15	» 2 = 20
Difference with normal ration	+ 45	+ 60	+ 45	+ 60
Yield with carbohydrates as percentage of that with normal ration	55	40	25	25

(*) See note to previous table.

C. *Comparison between yields with amides and yields with carbohydrates.*

RATION	Method I		Method II	
	A	*B*	*A*	*B*
Amides	Per. 2 = 60	Per. 3 = 70	Per. 2 = 40 (*)	Per. 3 = 30 (*)
Carbohydrates	» 3 = 55	» 2 = 40	» 3 = 15 (*)	» 2 = 20 (*)
Difference with amides . .	+ 5	+ 30	+ 25	+ 10
Yield with amides as percentage of that with carbohydrates	92	57	38	67

(*) See note to table *A*.

These comparisons confirm what has been said ; table *C* also shows that even method II does not give sound results in the comparison of two intermediate periods with one another.

The writers consider that *the most correct method consists in comparing the yields of the intermediate periods to the yield of the intitial period reckoned as* 100, as in the following example :

A

Amides Period 2 ; 80 : 40 :: 100 : x ; $\therefore x = 50$
Carbohydrates. Period 3 ; 60 : 15 :: 100 : x ; $\therefore x = 25$

Difference with amides : + 25

B.

Amides Period 3 ; 60 : 30 :: 100 : x ; $\therefore x = 50$
Carbohydrates. Period 2 ; 80 : 20 :: 100 : x ; $\therefore x = 25$

Difference with amides : + 25

In both cases the yield due to carbohydrates comes out at 50 % of that due to amides.

These examples show that :

The differences shown by calculation between the yield of the initial period (normal food) and the yields of periods 2 and 3 are identical in the two methods ; but only those calculated by method II allow of the calculation of the relationship shown above, as those from method I are based on two inexact factors.

The proportional percentages come out different with the two methods, only those from method II being exact.

The difference with the amide ration comes to 40 when the amides are given in period 2 (case *A*), and to 30 when they are given in period 3 (case *B*). With the carbohydrate ration the results are also different in the two cases. But as the relations between the yields from amides and carbohydrates respectively and the yield from the normal ration (initial period) do not vary, these differences in the results are not justified, so that the calculations evidently give erroneous results and cannot be used to indicate the *extent* of the influence of the foods.

The comparisons can only be made between the proportional percentages calculated by method II, or else on the basis of the differences calculated by the same method and reduced to the yield of the initial period reckoned as 100.

The article contains numerous calculations and tables based on the method proposed by the writers and applied to a number of experiments carried out by them.

1316 – **A Practical Method of Increasing Meat Production and of Decreasing its Net Cost.**

GOUIN, ANDRÉ and ANDOUART, P. Moyen pratique d'augmenter la production de la viande et d'en abaisser le prix de revient. — *Bulletin des Séances de la Société nationale d'Agriculture de France*, Tome LXXII, No 6, pp. 489-495. Paris, 1912.

Studies on the feeding of young cattle. The experiments of the writers extend over a period of 775 days during which the 13 animals experimented upon (young cattle and calves from 13 to 18 months old) were treated in a normal manner.. The forage consumed was analysed and weighed, as was also the excrement of the animals ; further, the increase in weight was minutely noted.

Some years ago, the writers established a distinction between the expenses of maintenance proper and those of growth. The quantity of food needed by the body is determined by its surface, and amounts to 500 gram of nutritive substance per square metre of the latter. As it is practically impossible to measure the surface of an animal while it is living, the proportion of the weight to the surface in a slaughtered animal is ascertained.

The expense of maintenance having been calculated according to this proportion and thus delimited, the writers found that the cost of growth consists of two elements :

1) The materials devoted to growth, about 370 gr. of nutritive principles per kilogram gained during youth.

2). The cost of the work necessary for transforming into living matter the nutritive principles which have been absorbed. For a gain of

one kilogram, the work of growth requires 500 gr. of nutritive principles per 100 kg. of body weight. Thus in the case of a calf weighing 50 kg., the cost of work for growth only corresponds to $^2/_3$ of the value of the matters fixed in the organism, while in that of an animal of 500 kg., the work of fixing an equal amount of substances would be nearly 7 times their value.

The actual cost of the subject of the experiment in nutritive substances, as well as the expenses calculated according to the above-mentioned laws, are given in a table, and are shown to agree well; thus the digressions in the case of the animals of 3 to 6 months old are only — 4.01 to 4.63 %. This small variation is easily accounted for by the fact that the formula employed in calculating the body-surface cannot be considered as invariable for all animals.

Taking their experiments as a base, the writers have calculated the cost of meat production for animals of different ages.

a) A young calf of 3 ½ months will weigh 150 kg. Allowing for a monthly gain of 20 kg., it will in 12 months have attained a weight of 390 kg. Its average weight during this period will be about 270 kg. corresponding to a surface of 4.04 sq. metres.

It will have consumed during these 365 days :

	Nutritive principles.
1. For its support $4.04 \times 500 \times 365$	737.3 kg
2. For the materials required by a growth of 240 kg., 240×0.370	88.8 kg.
3. For the work of increase $240 \times 270 \times \frac{500}{100}$	324.0 kg.
Total for 240 kg.	1150.1 kg.

that is to say 4.792 kg. for each kg. gained.

b) If this animal is kept another 6 months and the rate of growth is maintained at 20 kg. per month, the cost will be as follows, for an average weight of 450 kg. and a surface of 5.68 sq. metres.

	Nutritive principles
1. Maintenance $5.68 \times 500 \times 183$	519.72 kg.
2. For the materials required for an increase of 120 kg., 120×0.370	44.40 »
3. For the work of increase $120 + 450 + \frac{500}{100}$	270.00 »
Total for 120 kg.	834.12 kg.

or for each kg. gained, 6.868 kg., instead of the 4.792 kg. gained during the preceding period ; *viz.* 43 % more than from the 4th. to the 15th. month.

From the 22nd. to the 24th. month, the cost rises to nearly 66 %. Subsequently, it continues to increase.

It is evident that the cost of feeding increases in the same proportion. As far as the breeder is concerned, his best plan is to keep early maturing breeds and to send the animals young to the butcher. This is already done in certain countries where " baby beef " is consumed.

1317 – **On the Feeding-Value of Potato Haulm and Berries.**

VÖLTZ, WILHELM. Ueber den Futterwert des Kartoffelkrauts und der Kartoffelbeeren, — *Zeitschrift für Spiritusindustrie*, XXXV. Jahrgang, Nos. 28, 29 and 30, pp, 377-78, 389-90, and 404-05. Berlin, 11., 18 and 25. Juli 1912.

The writer has carried out feeding-experiments with potato haulm and berries at the Institute of Fermentation Industries in Berlin. Two wethers were the subjects experimented upon.

The potato haulm used had been harvested at the beginning of October; it had been partially dried in the field on " Kleepyramiden " and further dried on a kiln.

One wether received, during one experiment period, 700 gr. of meadow hay and 200 gr. of potato haulm; the other 800 gr. of potato haulm per day. In both cases, the fodder was fed chopped. During the other experiment period, a rather different mixture was given.

The chemical analysis of the potato haulm gave the following data: water 19,83 %, dry matter 80.17 %, ash 10.72 %, organic matter 69.45 %, crude protein 10.13 %, crude fat 3.58 %, crude fibre 27.03 %, N-free extract 28.71 %.

The average digestibility during the feeding-experiment was found to be as follows: organic matter 64.7 %, crude protein 61.2 % crude fat 41.7, crude fibre 56.4 %, N-free extract 76.9 %. A difference in digestibility was, however, shown to be caused by the mixing of the feed: when mixed with meadow hay potato haulm was about $^1/_5$ more digestible than when fed alone. The writer lays great stress on this fact; he remarks that, as a general rule, the digestibility of a feed is increased by other food substances fed at the same time. Hence it follows, that the nutritive value (*stärkwert*) of a feed cannot be exactly estimated: it may be greater or less, according to the suitability of the mixture of which the food forms a part.

During one of the experiment periods, dried potato berries were also given. These, as well as the potato haulm, were always eaten with avidity, and no bad results were observed.

The writer states that in the case of many late kinds of potato, especially of those used in distilling, the haulm is still green at havest time and thus has a considerable value as a feed, being little inferior in this respect to good meadow hay.

The yield of green haulm varies between 4 and 5 tons per acre. This large quantity of vegetable matter, hitherto little used, can now be turned to account. As it is often impossible to dry the haulm in the open, recourse must be had to drying-apparatus. Silos might also generally be used for the purpose. Further experiments are to be made with potato-haulm silage.

BREEDING

1318 – **Evidence of Alternative Inheritance in the F2 Generation from Crosses of *Bos indicus* on *Bos taurus*.**

NABOURS, ROBERT K. in *The American Naturalist*, Vol. XLVI, No. 547, pp. 428-436. Lancaster-Garrison — New York, July 1912.

The writer gives a short description of the Zebu or Brahma (*Bos indicus*); he states that those imported into the United States in 1853 by Davis were probably the first to enter that country. In the South-West States and Mexico there are still to be found many beasts showing traces of Zebu blood. In general, such hybrids are larger and more healthy than the ordinary cattle.

In 1906, Mr. A. P. Borden introduced some 30 young Zebus, mostly bulls, to Pierce (Texas); he used them for crossing with grade Hereford and Durham cows and also with the local cows. In the F_1 generation from the Zebu × Hereford cross, the colour of the Hereford is mostly dominant; similarly in Zebu × Durham the Durham colour is dominant, but in this case some Zebu characters show. The offspring of Zebu bull on native Texas cows showed lack of uniformity; this was probably due to their being descended from earlier crosses with Zebu.

Three of Mr. Borden's herds are described and photographs of them are given. Herd No. 1 consists of about thirty F_1 cows, of which twenty-four were put to their Zebu × Durham half-brother, producing eighteen calves: six of these are white and resemble their Zebu grandfather; the remainder mostly resemble the Durham. Herd No. 2 consists of F_1 cows from Zebu × grade Hereford and Durham; about half of the F_2 offspring from putting these to a Zebu bull show Zebu characters, while the rest are like their hybrid mothers. Similar characters are shown in Herd No. 3, consisting of cows from Zebu × high-grade Hereford crosses.

Pure Zebus and the F_1 hybrids are immune from Texas cattle ticks; whether the F_2 generation shares this immunity is not yet certain.

The crosses have the additional advantage of being 50 % heavier than the ordinary range beasts. The considerable fertility of the Brahma (Zebu) bull is also mentioned.

From his observations the writer concludes that in the F_1 generation, Hereford and Durham colour is dominant; but the humps and deep dewlap and sheath of the Zebu also show in the first generation. In the second generation splitting takes place according to Mendel's law; but no positive conclusions can yet be drawn as to the ratios.

1319 – **Sex-Limited Inheritance in Poultry.**

DAVENPORT, C. B in *The Journal of Experimental Zoology*, Vol. 13, No 1, pp. 1-26. Philadelphia, July 5, 1912.

The problem of sex-limited inheritance has been investigated recently by experimental breeding and by the method of cytological study. The results thus obtained point to the same conclusion, namely that it may be assumed that sex-limited characters have their determiners in the sex-chromosome. When the results hitherto obtained are applied to poultry it seems that the male fowl is positively homozygous or as the author prefers to call it *duplex*, that is that it has two sex chromosomes in the somatic cell. Consequently each of its sperm-cells contains a sex-chromosome. The female fowl on the other hand is heterozygous, or *simplex*, that is it possesses only one sex-chromosome to the cell. Consequently only half of the *matured* eggs of a hen have a sex-chromosome. The other eggs lack it. The union of two germ cells that both contain a sex-chromosome determines a *duplex* (male) ; the fertilization of an egg that lacks a sex-chromosome determines a *simplex* (female). According to this hypothesis, the male progeny of crosses will be influenced by both parents, since in each a sex-chromosome is present ; on the other hand the daughters show the sex-limited characters of their sires only as no sex-chromosome from the mother is present in the product.

The experiments of Doncaster and Raynor on *Abraxis grossulariata*, the English currant moth, and its variety *A. lacticolor* show that *grossulariata* possesses a factor *G* which in *lacticolor* has been lost. In crossing *grossulariata* ♂ with *lacticolor* ♀ the whole F_1 generation was *A. grossulariata*. On mating these together all the ♂ ♂ were *grossulariata*, while of the ♀ ♀ 50 % were *grossulariata* and 50 % *lacticolor*, which agrees with the above hypothesis.

The experiments of Durham and Marryat on canary birds, also support the hypothesis that the males are *duplex* and the females *simplex*.

The writer reports on the experiments on fowls of several investigators and then gives the results of his own experiments which also were made on fowls. He used Brown Leghorns and Dark Brahmas, two races that have very dissimilar plumage colorations and exhibit a sex-dimorphism in pattern and colour, as is well shown by the coloured plates which accompany Mr. Davenport's paper. In the Br. Leghorn ♂ the hackle and saddle feathers are red laced ; the upper wing-coverts are red ; while in the Dark Brahma ♂ these parts of the plumage are white. The Br. Leghorn ♀ have golden-yellow laced hackle feathers; the back and upper wing-coverts are light brown mixed with deeper colour. The Brahma ♀ has silver-white laced hackle ; the feathers of the back and the upper wing-coverts are gray with three concentric black loops (pencilled).

Crosses were made between a Brown Leghorn cock and Dark Brahma hens and between a Dark Brahma cock and one Brown Leghorn hen. The 27 males of the F_1 generation from both crosses were all alike. They had the Dark Brahma's white lacing of the hackle feathers and the red upper wing-coverts of the Brown Leghorn. In the 27 females, while the ground-colour was distinctly inherited from the fathers, the pattern and the colour of the wing-coverts were truly intermediate and similar in the two crosses. It may therefore be assumed that the differences in colour determined by sex are not always sex-limited, that is, they may be inherited independently of sex.

The hybrids of the F_1 generation were mated together. Admitting that the Brahmas have a factor *W* (inhibitor of formation of red pigment) which causes the white lacing of the hackle feathers, and that the Leghorns lack this factor (*w*, absence of white) it is clear that the male offspring of the F_1 generation of Br. Leghorn ♂ and Dark Brahma ♀ bear a factor *W* and a factor *w*. According to the hypothesis, only one half of the eggs possesses sex-chromosomes. Females are produced from eggs without sex-chromosomes. Therefore all the female offspring of Br. Leghorn ♂ and D. Brahma ♀ have only *w*.; the formation of colour is not prevented and the golden-yellow lacing of the hackle feathers appears, as was the case in all the 23 birds of the experiment. As, by hypothesis, the sex-limited characters are dependent upon the composition of the germ-cell, in the F_2 generation an equal number of males with white and with red lacing may be expected and among the females equal numbers of white and of golden lacing according to the formula:

	♂ ♂	♀ ♀
Gametes F_1	*W* *w*	*w*
F_2	*W W* *w W*	*W* *w*

Actually in the F2 generation there were eight cocks with white and four with red lacing to the hackle feathers, and the white-laced and golden-laced pullets were in the proportion of 10 to 7. Though this proportion does not agree perfectly with the expectation, it is explained by the small number of the birds: with a more numerous offspring a better concordance would doubtless be obtained.

According to the hypothesis, the sperms of the hybrids carry in equal numbers, red bar on the upper wing-coverts (Leghorn) and no red (white) bar (Brahma) while the eggs all carry red bar. In the F_2 generation two

kinds of males are to be expected: namely *duplex* and *simplex* red bar. All the offspring had red wing-bar, as expected, but in some cases less strongly developed than in the pure Brown Leghorn race.

The matings of hybrids of the reciprocal cross: Dark Brahma ♂ with Br. Leghorn ♀ yielded only two males and four females; but the results are not without interest. The F_1 generation hybrids when mated should give: (*W* determinant for white-laced hackles).

	♂ ♂	♀ ♀
Gametes F_1	*w* *W*	*W*
F_2	*WW* *Ww*	*W* *w*

It follows that all the males and half of the females should have white lacing and half the females red lacing. Actually each class was represented in exactly the expected proportions.

Lastly there is the difference in the upper wing-coverts. According to the hypothesis the Leghorn males have a determinant for red *R*, which the Brahmas lack, *r*. The females have only *r*. Consequently for the upper wing-coverts the formula is the following:

(*R* determinant for red bar on upper wing-coverts)

	♂ ♂	♀ ♀
Gametes F_1	*R* *r*	*r*
F_2	*R r* *r r*	— —

According to the above, one half of the males should have red-barred wing-covert feathers and half white-barred. This also was confirmed by experiment.

Conclusions. — The foregoing observations thus accord with the hypothesis that the male carries two sex-chromosomes and the female one; and that the determiners for certain secondary sex-characters are centered in the sex-chromosomes. The development of many secondary sex-characters seems, however, to be influenced or modified by secretions of the sex-glands. It seems also that determiners for several sex-limited characters (for instance, white-laced hackle and red-barred wing-coverts) may be present in the same sex-chromosome.

WORK OF LIVE STOCK ASSOCIATIONS AND OTHERS FOR THE ENCOURAGEMENT OF BREEDING.

1320 – **Society for the Improvement of Breeds of Live Stock, at Braila, Roumania.**

Societatea de incurajare pentru imbunătătirea rassei animalelor cu sediul in Braila. — *Câmpul*, Anul-al XI-lea, No. 6, pp. 183-184. Bucureşti, Junie 1912.

As appears from the report of the Managing Committee on the work of the above Society during 1911, it arranged competitions in the spring and autumn, offering 19 prizes of the total value of £ 1014. A stallion of the Percheron breed was given to the Society by a private individual; two others of Anglo-Arab breed taken from the studs were granted by the Ministry of Agriculture and Domains, considering that the Society was not in a position to meet all the applications which came to hand. In 1911 the Society had 11 stallions of different breeds, which covered 445 mares of 373 owners, as against 430 mares of 349 owners in 1910. As in previous years, the Society arranged a show with prizes for the products of its stal lions. It was held in October 1911, 131 horses being exhibited. In the Stud Book of the halfbreds there were entered in 1911, 236 colts and fillies. On the 31st. December 1911 the Society numbered 173 members. Its balance sheet in 1911 closed with about £2 600 of receipts and about £2 300 expenditure.

CATTLE

1321 – **Silage for Fattening Steers.**

EVVARD, JOHN M. & KENNEDY, W. S. *Communication of the Iowa State College, Division of Agriculture and Experiment Station.*

During the last two winters, the Iowa Experiment Station has conducted feeding trials with steers in order to test the cheapness of corn silage as a fattening feed for cattle. The steers were fed under the supervision of the Authors cited above.

1. In the trial of 1910-1911, twenty of the cattle were brought from Wyoming and twenty from Nebraska ranges. They were so divided in the four lots of ten each that five Nebraska and five Wyoming steers were grouped together in each lot.

The rations fed in the four different lots were as follows:

Lot 1 — Shelled corn, cottonseed meal, clover hay.

Lot 2 — Shelled corn, cottonseed meal (last sixty days only) clover hay and silage (limited).

Lot 3 — Shelled corn, cottonseed meal, clover hay and corn silage (unlimited).

Lot 4 — Shelled corn, cottonseed meal and corn silage (unlimited)

The feeds were valued as follows:

Shelled corn 36 cents per bushel.
Cottonseed meal $28.00 per ton.
Clover hay $10.00 per ton.
Corn silage $2.50 per ton.

The valuations for corn, cottonseed meal and clover hay were based upon the current valuations during the progress of the experiment.

The efficiency of silage for short feeding was abundantly demonstrated. In other words, the silage cattle did best in comparison with the clover lot during the first ninety to one hundred and twenty days, and from that time on until the finish of the experiment made comparatively less economical gain than did the steers feeding upon clover.

The following table illustrates this point quite clearly. In it are shown the daily gains for three, four and five months feeding respectively and also the cost per cwt. of gain by these same periods.

TABLE II.

	Lot. 1 Shelled corn. C. S. Meal Clover	Lot. 3 Shelled corn. C. S. Meal Silage and Clover	Lot. 4 Shelled corn. C. S. Meal Silage
Average Daily Gains.			
	lbs.	lbs.	lbs.
First 90 days	2.30	2.73	3.11
First 120 days	2.66	2.44	2.63
Entire period 150 days	2.61	2.22	2.45
Cost of 100 lbs gain not counting pork produced.			
	$	$	$
First 90 days	7.15	6.39	5.84
First 120 days	7.84	7.27	6.12
Entire period 150 days	7.91	7.99	7.32

In comparison made, only Lots 1, 3 and 4 are given, because Lot 2 is not quite comparable to the other lots because they did not receive cottonseed meal during the first three months of the feeding period.

The exclusive silage roughness steers made the cheapest gain for the entire feeding period. It is also worthy of notice that the ration having the largest proportion of silage made the most economical gain both including and excluding pork profits. That silage is a cheap meat producer is shown in the data.

When it is remembered that these cattle were sold upon a disastrous market, such as the old timers in the business have not seen in many years, it is exceedingly gratifying to know that the silage fed cattle practically held their own. In other words, they lacked only 2 cents per cwt. of paying for all the feed they ate. This is counting the pork that is picked up from the droppings.

The cost of silage is figured in the above table at $ 2.50 per ton, but actually this silage cost this station $ 1.92. This cost includes the wear and tear on the silage machinery, the labor, twine, corn binder, etc. The

TABLE I.

Resumé 1910-1911 *Steer Feeding.*

Record - November 22 to April 21 - 150 days.

Ten steers in a lot.

	Lot 1 Shelled Corn C. S. Meal Clover	Lot. 2 Shelled Corn C. S. Meal - last 60 days only Clover Silage	Lot 3 S. Corn Clover C. S. Meal Silage	Lot 4 S. Corn C. S. Meal Silage
	lbs.	lbs.	lbs.	lbs.
Initial weight	977.8	1008.0	988.7	993.6
Final weight	1370.0	1302.6	1322.3	1362.2
Total gain per steer	392.2	294.6	333.6	368.6
Ave. Daily gain	26.1	1.96	2.22	2.45
Ave. daily feed eaten:	lbs.	lbs.	lbs.	lbs.
Shelled corn	19.24	14.58	14.07	14.93
C. S. Meal	2.07	0.88	2.54	3.31
Clover hay	10.83	6.65	4.35	—
Corn Silage	—	18.35	23.86	30.15
Feed required per pound gain.	lbs.	lbs.	lbs.	lbs.
Shelled corn	7.36	7.42	6.33	6.08
C. S. Meal	0.79	0.45	1.14	1.34
Clover hay	4.14	3.39	1.96	—
Corn Silage	—	9.39	10.73	12.27

Cost per 100 lbs gain excluding pork profits.				
	$ 7.91	$ 8.26	$ 7.99	$ 7.32
Profits returned by hogs at $6.00 per cwt. for each 100 lbs gain on steers.				
	$ 1.47	$ 1.44	$ 1.53	$ 1.55
Net cost per 100 lbs (including pork profits) gain on steers.				
	$ 6.44	$ 6.82	$ 6.46	$ 5.77
Total pork produced per lot.				
	lbs. 1497	lbs. 1243	lbs. 1386	lbs. 1490
Initial cost of feeders in lots per 100 lbs.				
	$ 5.50	$ 5.50	$ 5.50	$ 5.50
Necessary selling price per 100 lbs Chicago including Hog Profits.				
	$ 6.20	$ 6.18	$ 6.15	$ 6.02
Chicago selling price.				
	$ 6.00	$ 5.90	$ 6.10	$ 6.00
Market weight at Chicago per steer.				
	lbs. 1335	lbs. 1283	lbs. 1296	lbs. 1323
Total shrink per steer.				
	lbs. 35	lbs. 19.6	lbs. 26.3	lbs. 37.2
Per cent. shrink.				
	% 2.548	% 1.504	% 1.989	% 2.731

total cost of $ 1.92 per ton, however, does not include the cost of the silo and its depreciation. Hence it will be seen that the value of $ 2.50 per ton really allows $ 58 more than actual cost of the silage, which would be more than sufficient to allow for the depreciation and interest in the investment.

Undoubtedly there is a great deal to be learned concerning the manner in which silage should be fed and it is with these ideas in mind that the Iowa Station is taking up the problem. The results this year would indicate that silage can be profitably limited during the last two months of the feeding period.

II. In the test of the winter 1911-1912, the value of corn silage as an efficient and economical feed was fully proved. The animals fed on silage made cheaper gains, they lost less in shrinkage, and they returned greater profits than other animals in the test fed on clover hay as roughage. The silage-fed steers put on gains at a net cost that was $2.01 per 100 lbs. less than the clover-hay-fed steers, and the best lot of silage-fed steers made a profit of $23.46 per animal as against $17.27 per animal for those fed with clover-hay.

Fifty steers were fed in this test for 150 days. Their rations were as follows:

Lot 1 — Shelled corn, cottonseed meal, clover hay.
Lot 2 — Shelled corn, cottonsed meal, clover hay, corn silage.
Lot 3 — Shelled corn, cottonseed meal, corn silage.
(The above lots were all put on full feed of grain in 40 days).
Lot 4 — Shelled corn, cottonseed meal, corn silage.
Lot 5 — Shelled corn, cottonseed meal, corn silage.

Lot 4 and Lot 5 were handled the same the first 90 days, silage fed heavily and shelled corn increased to full feed in the 90 days as follows: First month, 6.44 lbs.; second, 10.48 lbs., third, 14.97 lbs. daily. Beginning the 91st day, Lot 4 was allowed corn and silage according to appetite, while Lot 5 was held back on silage and shoved hard on corn, the object being to make the ration concentrated at the end of the fattening period. Cottonseed meal was allowed in equal amounts of practically 2 3/4 pounds daily to Lots 2 and 5. Lot 1, because of clover, which contains protein, was fed somewhat less for best results.

All feeds were charged at actual market prices as follows: Shelled corn, first month, 50 cents; second 51 cents; third 55 cents; fourth 57 cents and fifth 65 cents per bushel; cottonseed meal, $28 a ton; clover hay, $15 a ton; corn silage, $3.20 a ton.

The silage cost is based upon the actual value of corn in field — 8 cents below market — at time of siloing. Cost of filling silo, storage of silage, and depreciation on equipement are included. This allows the far-

mer a field profit on the corn. The actual production cost on this silage would not exceed $2.40 a ton.

All roughage was fed twice according to the steer's appetite, excepting in Lot 5 last two months, where it was limited.

Hogs following cattle were valued at $6.10 first three months and $7.50 last two.

The record of feed, gains, costs and profits follows in lots for the entire feeding period:

TABLE III.

Detailed Statement of Results.

Ten Two-year-Old Steers in Each Lot.

	Lot 1	Lot 2	Lot 3	Lot 4	Lot 5
	lbs	lbs	lbs	lbs	lbs
Initial weight	940.	943.	919.	920.6	922.8
Final weight	1229.7	1299.	1261.3	1246.	1257.
Av. daily gain	2.398	2.373	2.281	2.169	2.228
Average feed eaten per steer daily in pounds:					
Shelled corn	20.20	16.95	15.60	13.71	14.64
Cottonseed meal	2.28	3.08	3.08	3.08	3.08
Clover hay	9.02	3.90	—	—	—
Corn silage	—	22.35	27.10	30.81	28.62
	$	$	$	$	$
Cost of 100 pounds gain, excluding hogs.	12.63	11.77	10.65	10.74	10.72
Net cost of 100 pounds gain on steers, deducting hog profits	10.83	9.62	9.10	9.08	8.81
Actual selling price (1) at Ames (2), deducting cost of shipment and shrink from Chicago values.	7.69	7.72	7.61	7.60	7.62
Net profits on each steer	17.27	22.22	22.03	22.45	23.46
Per cent shrink.	2.669%	1.617%	2.482%	2.568%	2.307%

Last year's (1910) trials with silage are strictly in accord with these figures of 1911.

(1) Chicago values are Lot 1, $8.20; Lot 2, $8.15, Lot 3, 4 and 5, $8.10.
(2) Seat of the Iowa Station. (*Ed.*).

1322 – Buffalo Breeding in the Western Transcaucasus

TURKIN, E. Bulvoli v Sepadnom Sakavkasie (Buffaloes in W. Transcaucasus). — *Molocnoie Khoziaistvo i Skotovodstvo* (The Dairy Farm and Cattle Rearing), God XI, N. 23. pp. 461-463; Moskva, 10 Junia 1912.

SICORZOFF, I. Niaskolko Slov o Bullovodstvie v Sapadnom Sakavkasie (A few Words on Buffalo-Rearing in the Transcaucasus). — *Ibid.*, pp. 464-465.

The largest number of buffaloes in the Western Transcaucasus are met with in the regions of the Rion valley and along the shores of the Black Sea. Here, in winter, the temperature is relatively mild and cool spots can be found during the summer heat on the banks of the rivers, the shores of the lakes, and in the swamps. Buffaloes are excellent animals for work, being strong and thrifty. They usually calve during the summer and afford large quantities of milk in the autumn, just at the time when there is a scarcity of cows' milk. During the summer, the buffulo bulls and cows are turned loose in the fields and woods, while the animals employed in work are given the following daily ration: More than half a hundredweight of hay and chopped straw, 2 to 4 lbs. of maize or more, either crushed, or in the form of meal. Buffalo cows are given during the first fortnight after calving, 2 to 4 lbs. of maize twice a day.

During the winter, they live in a specially prepared place, a kind of shelter partly excavated in the ground and with its walls smeared with dung and clay.

With regard to work, a buffalo can easily draw a cart containing a load of more than 24 cwt.

The average yield of milk during the best season is from 1 3/4 to 2 ½ gallons daily; the milk is rich in fat (4 to 7 %), and one buffalo can supply as much as 175 lbs. of butter annually. In some districts, butter is made from sour milk and thus acquires a special taste and keeps better.

These qualities make the buffalo a much valued animal on the farms of Transcaucasia and justify its wide distribution. In the district of Sukum, there are 13 700 head; 6 978 in Sugdid; 2 101 in Kutai; 1 508 in Sena; 1 305 in Sciaropan; 358 at Osurgeti; 62 at Racin, and 40, 910, and 628 at Leckum, Artvin and Batum respectively; in all, 27 610 head. Sikorzov, who from the above data draws the happiest auguries for the future of the breeding of buffalo in the Transcaucasus, insists on the systematic introduction of fresh blood and a careful process of selection which, according to him, would result in the production of local varieties furnishing the best quality of milk and of meat, not only in Transcaucasus, but also in many other parts of Russia.

1323 – Silage for Breeding Ewes. SHEEP

EVVARD, JOHN M. *Communication of the Iowa State College, Division of Agriculture and Experiment Station.*

Last year the Animal Husbandry Section of the Iowa Experiment Station conducted a comprehensive feeding trial with four lots of breeding ewes in order to work out the best corn-belt rations for wintering them.

The object of this experiment was to determine as accurately as possible, whether or not silage was responsible for under sized and weak lambs at birth. Nevertheless this experiment gives some important lights upon the saving of a large percentage of the usual winter maintenance cost through the judicious and intelligent use of corn silage. The rations fed are as follows:

Lot 1. Clover hay according to appetite, plus a grain mixture of corn four parts, oats two parts, bran one part. The lambs from this lot averaged at birth 8.192 lbs. 100 % of these were strong in vitality.

Lot 2. Clover hay according to appetite and corn silage, allowing twice as much silage as hay plus a grain mixture of corn one part, oats two parts, bran one part. The average weight of lambs in this lot was 8.636 lbs. 100 % of these lambs were strong.

Lot 3. Corn silage according to appetite, plus a grain mixture of oats one part, bran one part. The lambs in this lot averaged 8.023 lbs. 100 % of these lambs were strong.

Lot 4. Corn silage according to appetite, plus cottonseed meal, the latter at the rate of 1 lb. to every 30 lbs. of corn silage. The average weight of each lamb in this lot was 7.282 lbs.; 82% of these lambs were strong and 18 % weak. It is well to remark in passing, that the 18 % weak lambs was due, in the judgment of the experimenters, to the advanced age of the ewes which produced them, rather than to the evil effects of the ration.

It is quite evident that within reasonable limits, the lambs should be quite large at birth, strong in vitality and should possess good underpinning. The rations above used varied in their effects upon the production of such lambs. The economy of the various rations was in favour of those lots which received the largest amount of corn silage. A statement of the economy of keep in the various lots is interesting.

In figuring the daily maintenance cost per ewe during the period, her gain was credited at $. 05 per lb. and all feed was charged at market prices. Good breeding ewes are worth $. 05 per lb.; if they are not, the logical thing to do is not to keep them for breeding purposes. This credit then, is quite fair and insomuch as it affects all lots equally is not to be questioned insofar as the experimental results are concerned. On the above basis the daily maintenance cost per ewe in the various lots was as follows:

Lot	1	1.37 cents
Lot	2	1.02 »
Lot	3	0.78 »
Lot	4	0.68 »

The feeds in figuring the above maintenance cost are valued as follows:

Shelled corn $ 0.40 per bu. or $ 0.714 per cwt.
Oats $ 0.30 per bu. or $ 0.937 per cwt.
Bran $ 0.125 per cwt.
Clover hay $ 10.00 per ton or $ 0.50 per cwt.
Corn silage $ 2.50 per ton or $ 0.125 per cwt.
Cottonseed meal $ 30.00 per ton or $ 1.50 per cwt.

As shown by lot 4, corn silage given as an exclusive roughage, even though suplemented with the necessary amount of protein, is still not as successful as where a leguminous hay is allowed. By leguminous hays, of course, are meant alfalfa and clover. The average birth weight of lambs in lot 4 was less than any of the other lots. Their weight could have been increased to quite an extent by the addition of clover hay and perhaps a little oats to the ration. Unfortunately in lot 4 cottonseed meal as well as corn silage, is somewhat lacking in the element calcium, which element is quite essential in the formation of bone. Compared to the leguminous hays, alfalfa and clover, the content of this essential element in cottonseed meal is about 1 to 7 in unit amount of dry substance from these feeds. It is interesting to relate that these lambs which were born in lot 4 showed in both their front and hind shin bones less circumference than any of the other lots.

Lot 2 which reveived clover hay, corn silage and a grain mixture of corn one part, oats two parts and bran one part, had the largest bones of any of the lots. The average gain per ewe was about the same in all of the lots during the winter period. The range of gain per ewe in the 120 days of the experiment was from 10 to 15 lbs. Ordinarily it was reckoned that the ewe should gain during the winter period enough to counter-balance the loss due to lambing plus the weight of the fleece produced. On the average this will mean that in the pregnancy period of 147 days, the ewe should gain about 25 to 30 lbs. This, of course, is taking it for granted that the ewe was in good condition at the time of breeding; if in thin condition at this time, her gain had best run higher during the winter months, in accordance with the circumstances.

The saving of practically a half cent a day upon the winter keep of ewes is quite an item. If a man has a flock of 100 ewes this will mean that he is saving a half dollar a day, which saving from November 1st

to April 1st will total the very neat sum of $75.00. This will add quite a boost to the annual income from the ewe flock. Likewise, it will boost the good name of silage as a money-saving feed.

Let it be understood, however, that the Animal Husbandry Section does not at the present time advise the feeding of corn silage as an exclusive roughage, neither is it to be advised that corn silage be fed along with a grain ration of corn only. In the light of our present investigation this would be quite disastrous. By all means, a shepherd had best secure some clover or alfalfa hay to feed in conjunction with the silage. He had also best be careful not to allow the ewes to eat over 2 or 3 lbs. of silage for each lb. of hay. Silage as every feeder knows, is highly palatable and the ewes will leave the clover to partake of it. The thing to do then, is to limit the amount of silage fed to the above proportions. Along with this ration of silage and clover or alfalfa hay (and alfalfa is better than clover) enough grain should be fed to keep the ewes growing nicely. The grain required will be very little, under these conditions, and will not exceed more than ⅓ of a lb. per day. Equal parts of corn and oats will answer admirably for this grain. A little bran is not out of place. If the farmer does not have the oats or the bran, linseed oil meal and shelled corn mixed with a portion of 7 to 1 will give excellent results.

Further experiments will be carried out.

1324 – **Experiments in Fattening Swine on Soy-Bean Meal.** PIGS

HASELHOFF, EMIL. Schweinemastversuche mit Sojabohnenmehl. — *Fühlings Landwirtschaftliche Zeitung*, 61 Jahrgang, Heft 12, pp. 401-414. Stuttgart, 15. Juni 1912.

The first experiment was made in the winter of 1909-1910 with three lots of cross-bred pigs, each lot containing 12 animals (German Landschwein × Yorkshire), and the experiment lasted 85 days. The average weight per head at the beginning of the experiment was about 155 lbs.

All three lots received the same basal ration consisting of potatoes, skim milk, wheat bran and crushed maize ; the first lot were given, in addition, crushed barley and fish meal, the second sesame cake, and the third soy-bean meal. The potatoes were steamed, the rest of the food being mixed in before feeding. The proportions of food were suited to the live-weight of the pigs; though, through a mistake on the part of the feeder, a slight exception was made to this rule.

The nutritive value of the food was estimated by means of chemical analyses and is accurately given in tables. Unfortunately it was omitted to add how often, and at what hours in the day, the pigs were fed. The amount of food used and the increase in live-weight was carefully noted. The most important figures concerning this subject, as well as the production cost per 100 lbs of live-weight, are to be found in the accompanying tables.

	Amount of food used								Increase in live weight		Cost of production per 100 lbs. of live weight
	Potatoes	Skim milk	Wheat bran	Crushed maize	Crushed barley	Fish meal	Sesame cake	Soy-bean meal	Whole lot	Average per head per day	
	lbs	lbs.	lbs.	lbs	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	£ s. d.
Lot I	12 194	4 950	760	1003	1730	380	—	—	1502.5	19.15	1 19 4
Lot II. . . .	11 620	5 017	913	1495	—	—	992	—	1369.1	1.36	1 19 5
Lot III . . .	11 110	4 880	835	1258	—	—	—	880	1305.1	1.295	1 18 5

The second experiment was carried out in the winter of 1911-1912 with two lots of pigs (German Edelschwein), and lasted 79 days. The weight of the animals per head at the beginning was about 115 lbs.

The basal ration for all the pigs consisted this time of potatoes, mangolds, ground maize and fish meal. Group I had in addition crushed barley, group II soy-bean meal. The mangolds were given raw, the potatoes steamed, and the rest of the food was mixed and moistened when fed. This time, as before, the animals ate up their rations with avidity.

The accompanying table gives information as to the amount of food used, the increase in live weight and the production cost per 100 lbs live weight.

	Amount of Food Used						Increase in live weight		Cost of Production (1) per 100 lbs. live weight
	Potatoes	Mangolds	Crushed maize	Fish meal	Crushed barley	Soy-bean meal	Whole lot	Average per head per day	
	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	£ s d.
Lot I. . . .	3 289	4 610	3 093	375	1 151	—	1 283	1.37	2 3 7
Lot II . . .	3 143	4 503	3 563	82	—	498	1 218	1.30	2 0 5

(1) The food substances were in both experiments calculated at the market price. Feeding and tending expenses are included in the cost of production. For this ½*d.* is reckoned per pig per day. The higher cost per 100 lbs. live weight in the second experiment is due to the increased cost of the food.

From the results of both experiments, the writer comes to the conclusion that soy-bean meal is very suitable for fattening pigs. It gives flesh of equal weight to, and at the present prices of the food at somewhat less cost than, other food substances which have been tried, although the latter produce a rather higher daily increase of live weight in the animals.

1325 - Rape for Hogs.

EVVARD, JOHN M. in *The Breeder's Gazette*, Vol. LXII, No. 1 (No. 1597), pp. 15-16. Chicago, July 3, 1912.

The Iowa Experiment Station has done considerable work with Dwarf Essex rape as a green forage for hogs. For producing pork economically this pasture is practically the equal of medium red clover. In 1909 an acre of rape provided grazing for 17 hogs from spring to the middle of November (147 days). These hogs made an average daily gain of 0.81 lbs. They were fed maize (ear-corn) during the entire period, some meat meal being added during the last couple of months.

Considering the production cost of the rape at $9.20 (£1 17*s.* 9*d.*) per acre, the price of corn at 50 cents (2*s.*) per bushel, and that of meat meal at $2.50 (10*s.* 3*d.*) per cwt., the production of 100 lbs. live weight cost $3.63 (14*s.* 11*d.*). The net profits on an acre of rape, with the price of hogs at $5 (£1 0*s.* 6*d.*) were $27.50 (£5 13*s.*) per acre. The red clover handled the same year under practically the same conditions produced gains costing a trifle more than with rape, but owing to a longer pasturage season the clover returned a little larger net profit per acre.

In 1910 the gains per live weight on clover and on rape cost about the same as in 1909, but in this year the net returns per acre of rape were somewhat higher than with clover: $37.51 (£7 14*s.* 1*d.*) against $34.62 (£ 7 2*s.* 3*d.*).

According to analysis, rape in the fresh condition has 90.77 per cent. of moisture, while clover has only 78.98 per cent. Comparing the dry matter, rape contains 23.04 per cent protein, clover 19.05 per cent; rape has 43.82 per cent of carbohydrates and 3.41 per cent fat, clover 39.95 carbohydrates and 2.52 per cent fat.

In consequence of the results of these experiments the author recommends rape pasture for hogs together with maize (best of all if given in the ear) and meatmeal at the rate of 1 lb. for every 15 lbs. of maize.

Rape may be sown broadcast or drilled in 8-inch rows early in April, and be ready for pasturing the first week in June.

The hogs should not be turned on until the plants are from 12 to 14 inches high, and one must never allow such close pasturing as to leave only the bare stalks, because the chances are very small for the rape recovering. In autumn though, it is a good plan to have all the forage eaten off before the frosts wilt it down.

1326 - Results of the fourth Egg-Laying Competition (May 1911 to May 1912) of the Western Province Agricultural Society, Union of South Africa.

POULTRY

The Agricultural Journal of the Union of South Africa, Vol. III, No. 6, p. 858. Pretoria June 1912.

Final Resnlts.

(*Each pen contains 6 fowls*).

Pen Number	BREED	TOTALS			Pen Number	BREED	TOTALS		
		Eggs	Weight of Eggs				Eggs	Weight of Eggs	
			oz.	drms.				oz.	drms.
15	White Leghorn (Aust.-Amer.) . . .	777	1649	8	20	White Leghorn (Amer.)	664	1230	8
26	White Leghorn (Dan.-Amer.) . . .	850	1648	9	9 *	White Leghorn (Amer.-Dan.)	564	1224	0
16 *	White Leghorn (Eng.-Amer.)	781	1638	13	13 *	Rhode Island Red	555	1209	4
21	White Leghorn (Aust.)	830	1614	15	23	Brown Leghorn	626	1188	6
14	White Leghorn (Eng.)	799	1573	6	12 **	Black Leghorn	551	1183	4
24	White Wyandatte.	740	1479	8	4 **	White Leghorn (Amer.)	597	1176	5
10	Black Leghorn (Aust.).	711	1409	0	17	Brown Leghorn	565	1161	1
19 **	Brown Leghorn	664	1394	15	7 *	White Wyandotte.	624	1141	2
18 ***	White Legorn (Aust.)	704	1356	3	25	White Leghorn (Amer.-Aust.) . . .	551	1094	9
22	White Leghorn (Amer.)	684	1334	1	8	White Wyandotte.	554	1020	2
6 **	White Leghorn (Amer.)	632	1314	10	2	Silver Wyandotte	468	918	6
11 **	Brown Leghorn	647	1297	3	1	Buff Orpington	425	895	7
5 **	White Leghorn (Amer.)	575	1249	13	3 **	Black Minorca (R. C.)	314	621	9

* One hen died; not replaced.
** One hen died; replaced.
*** Two hens died; not replaced.

1327 - **Wild Honey; with Notes on the Moka Bee.** BEES

MARAIS, EUGÈNE N. in the *Agricultural Journal of the Union of S. Africa*, Vol. III, No. 6, pp. 790-795. Pretoria, June 1912.

Strange as it may seem, it is a fact beyond doubt that wild hives in the Northern Transvaal are never so rich in honey as during a severe drought. The first half of 1912 was exceedingly dry, and the veld was almost destitute of flowers, the only exception being the zoetdoorn (one of the acacias). These trees started flowering early in the season but soon the blossoms were parched by the sun and fell to the ground. Since then the trees have burst into flower after each little shower. Near Waterberg, the author's place of residence, they had been in flower already four times and during each blossoming they were visited by bees from sunrise to sunset and this perhaps explains the abundance of honey during periods of drought.

There are in Waterberg two kinds of honey made by the common bee. One is the golden-yellow kind known all the world over, while the other is absolutely snow white with a flavour and fragrance peculiarly its own. When expressed from the comb it almost immediately solidifies to the consistence of vaseline. It is known amagst the boers as " Sheep-tail fat honey," and is found on portions of the Springbuck flats and on the two middle velds. The pure white is said to be due to the fact that the bees extract the honey from certain grasses only. The hives are generally in hollow trees, occasionally in ant-bear holes or hollow ant hills, and the honey is much sought after, both on account of its beautiful appearance and exquisite flavour and on account of certain valuable therapeutic properties it is supposed to possess.

Except in the case of hives in rocky, almost inaccessible places, the extraction of honey is generally followed by complete destruction or dispersal of the swarm. Although the bee-hunters do all in their power to preserve a hive after robbing it of its honey, this is very seldom possible, and the bees nearly always desert the hive after the drastic smoking to which they are subjected. The krans (rocky eminence) hives are seldom permanently deserted after a marauding expedition. Many of them are situated in places of exceedingly difficult access, in addition to which the krans bees are generally the most vicious, while those in earths are generally the least pugnacious, and although the former are far richer in honey they are seldom disturbed.

The bee-hunters wear no protective clothing of any kind, but the majority of them have been so thoroughly inoculated with formic acid as to appear entirely immune from its effects.

Next to man the ratel (*Mellivora capensis*), one of the Mustelidae, is the most persistent and destructive of hive-robbers.

The honey is collected and kept in bags of tanned duiker or steenbok skins. These bags improve with age, and when thoroughly saturated with honey they become jet black.

The general favourite among all consumers and hunters of wild honey is the product of the little stingless Moka bees (1), of which there are two varieties; one kind, known as os-bije (ox-bees), is very small; the other is considerably larger. With the exception that they possess no sting they resemble in all points the common honey-bee.

This larger Moka builds only in the ground, in the hardest soil to be found, — those level barren tracts which the Afrikanders call "brak." In this almost impenetrable earth they dig a vertical shaft about the diameter of a lead pencil, and from two to five feet deep, at the bottom of which a hollow for the honey is excavated. The honey is stored quite apart from the comb in little wax bags about the size of a large thimble, cemented together with wax until a cluster about the size of an orange is formed. The shape of the entire bag is that of a Roman wine-amphora without the handles. Their necks all converge towards the shaft, and the bottoms widen out into the hollows. Between these bags the comb is made similar to that of the common bee, but the cells are smaller and contain no honey.

In flavour Moka differs widely from common honey, to which it is generally preferred. The quantity found in these hives varies considerably, from a few spoonfuls to two gallons, while the smaller Moka yield at most two tumblerfuls.

Both varieties are easily domesticated, as the Author has proved by experiment.

SILKWORMS

1328 – **Silkworm-Breeding in Austria.**

La Sériciculture en Autriche — *Le Moniteur des Soies*, 50ème Année, No. 2598, p. 5. Lyon, 13 juillet 1912.

The eggs put into incubation during the past few years reached a quantity of 50 000 ounces of 30 grams. They came from the South Tyrol, Istria and partly from Italy. The predominiting breeds are the young native breeds. Official control is only carried out upon application by the breeder. In the province of Trieste, a very limited territory, where the average crop of cocoons was 2 200 lbs. during the last five years, the Agricultural Society of Trieste distributes free of charge the eggs of the yellow

(1) The stingless social bees are tropical in their distribution and belong to the genus *Trigona*, several species of which have been reported from Africa. The species in question (the larger Moka bee) is closely allied to, if not identical with, *Trigona clypeata* Friese (Cfr N. FRIESE: *Die Bienen Afrikas nach dem Stande unserer heutigen Kenntnisse*. Jena 1909).

(Note by C. B. HARDENBERG, Transvaal Entomologist).

Japanese breed of Italian origin. The Agricultural Society of Trieste, which has no official character, exercises a kind of control through its agents, who go on tours of inspection. The average total production for the last five years was for Austria 5 500 000 lbs. of fresh cocoons. The province of Trieste only represents an average production of about 2 200 lbs. The average yield per ounce of eggs is 128 lbs. for the whole of the production, whilst the Agricultural Society of Trieste within its districts reckons on an average production of 165 to 176 lbs. per ounce.

The Government, in order to develop silkworm breeding in the Southern Austrian provinces, has created nurseries which distribute grafted mulberry trees at very low prices and even free of charge. It furthermore grants subsidies for measures of control against *Diaspis*; it subsidises co-operative societies for the joint sale of the cocoons; it organises propaganda work on the basis of publications and lectures for the cultivation of mulberry trees and breeding of silk-worms; and since 1869, at the Experimental Institute for Agricultural Chemistry at Gortz, studies in the breeding of the silkworm, its diseases, methods of controlling them and the possibilities of rational breeding have been in progress.

Almost the whole of the production of the Southern Austrian provinces is exported; the 63 100 lbs. of cocoons which Trieste exported in 1910 were distributed as follows: Austria-Hungary 27 700 lbs., Italy 34 300., and Germany 1 100.

On the other hand, the importation of cocoons into Austria is exempt from customs duties and Trieste imported in 1910 about 440 000 lbs. of cocoons, the major part of which (266 000 lbs.) came from European Turkey.

1329 – **Silkworm-Breeding in Spain.**

Producción de hojas de morera y capullos de gusano de seda en España, desde 1901 á 1910. — *Boletín de Agricultura Técnica y Economica*, Año IV, No. 42, pp. 497-591. Madrid, 30 de Junio de 1912.

In the Central Region of Spain (New Castile) silkworm-breeding is only important in the province of Toledo, in which it is however in clear retrogression in consequence of the disappearance of the mulberry trees which formerly existed in the valley of the Tagus.

In the region of La Mancha and Estramadura sericulture is only prominent in the province of Albacete. In Old Castile it is of little importance as it is only beginnning to be carried on in the province of Soria. In the region of Aragon and Rioja it has developed to some considerable extent, and the province of Logroño is the only one in which it is not carried on; in the provinces of Huesca and Teruel it is in decay, especially the former, in consequence of severe invasions of pébrine, frequent late frosts, shortage of labour and low price of cocoons. In the regions of Leon, Galicia, Asturias, Navarre and Vascongadas, and Catalonia the silkworm industry is in

ts inception. The East-Coast region (Levante) takes the lead in the industry ; of the four provinces comprised therein (Valencia, Alicante, Castellón and Murcia) data relating to production for a normal year are only available for that of Valencia. They are :

Production of mulberry leaves.	15 200 tons
» » cocoons	1 100 000 lbs.

In Eastern Andalusia silkworm-breding is only of importance in the provinces of Granada and Almeria. The particulars relating to this latter for a normal year are :

Production of mulberry leaves	122 ½ tons
» » cocoons	15 000 lbs.

In Western Andalusia the industry is only gaining some importance in the province of Cordova. In the Balearic Islands it is not practised.

The following table shows the production for the ten years 1901-1910 and that for the year 1910, in those Spanish provinces in which the industry is most developed.

Provinces	Mulberry leaves: tons.		Cocoons lbs.	
	1901-1910	1910	1901-1910	1910
Toledo	978	100	183 200	18 500
Albacete	7 470	738	440 000	43 600
Soria (1907-1910).	5 ½	½	840	66
Saragossa	929	126	138 000	22 000
Huesca	760	53	111 550	5 950
Teruel	3 137	125	500 000	22 000
Alicante.	23 300	2 360	2 167 000	220 000
Castellón	5 369	502	487 150	40 760
Murcia	139 000	12 600	12 392 000	1 590 000
Granada	6 700	453	452 000	30 000
Cordova	126	13	18 970	2 070
Canaries	1 167	108	26 400	2 640

1330 – Silk in Indo-China.

LEMARIÉ. La Soie en Indochine. *Bulletin de l'Office colonial*, Ve Année, No. 54, pp. 177-197. Melun, juin 1912.

The cultivation of mulberry trees and silkworm-breeding in Indo-China have been carried on from time immemorial. The white mulberry is cultivated there in low forms trom the sea shores up to the elevated plateaus ; it is propagated by slips. In the low moist alluvial soils the slips are put close together, so as to form continuous and close lines ; in higher soils they are placed at intervals, in twos generally, so as to form clumps far apart, each tree branching from the base. The rapidity of growth of these mulberries is marvellous ; 6 to 8 weeks after the slips have been put

in the ground, they are 6 feet high and the leaf crop begins. It lasts from April to November and allows of 6 to 10 broods being produced in the course of 8 months.

The Indo-Chinese breed of worm goes through several generations in the year.

The rearings are carried on entirely by families and are of small extent.

The eggs hatch 8 to 10 days after laying. The worms are put into large flat baskets made of split bamboo and placed on stands likewise of bamboo. A thick mosquito net around the stand, or an overturned basket covering the one containing the worms, protects the latter against enemies, especially mosquitos and flies. One of the latter, the " Oudji," a Tachinid, is parasitic on silkworms in its larval state. In addition to its enemies, a number of diseases threaten the rearings : the *rouge* due to a bacterium which appears to be special to the South of Indo- China ; *grasserie, flacherie, muscardine* and above all *pébrine.* When the time arrives for making their cocoons the Annamite worms do not climb onto heather; they must be placed on hurdles lined with wisps of straw. The hurdles are exposed to the sun if the weather allows. One week later the emergence from the cocoon takes place. But the natives, who are in a hurry to realise, do not always wait until the worms have completed their work and are converted into chrysalids. Disturbed in their work, the insects complete it by yielding a glazed cocoon which reels badly and very often not at all. Stoving and keeping the previously dried cocoons are measures not adopted by the natives. The cocoons are spun fresh ; rarely does the breeder wind them off himself. He frees them from the always abundant floss aronnd them and sells them. Women afterwards get out the raw silk, of a beautiful golden yellow. Almost everywhere a reel with a handle is used and a basin of hot water, which is very simple plant. The cocoons are almost always weak and pointed, giving considerable waste. It takes 640 to 680 to make 1 lb. weight ; 25 lbs. at least are needed to produce 1 lb. of raw silk.

The traditional basin is an earthenware or copper saucepan, heated direct. The water must rise to 70° to 75°C. to enable reeling off to be good. Beating is carried out by the aid of two sticks similar to chopsticks (the broom used in France would reduce everything to waste). In this way the bave or thread of the cocoon is quickly removed ; but they still yield 50 % of flocks or waste silk, that is to say as much as raw siilk. The spinner grips this waste with the left hand, beating with the right. She draws them out in a bunch and winds them on a vertical spindle. When she has finally isolated the basic thread of each of the cocoons she grips them in a single bundle, which forms the raw silk. This raw silk is wound on a hexagonal drum 1½ to 4 in. diagonal, driven by an assistant by means of a handle. Between the basin and the drum, the thread first

passes over a small pulley and then through the crochet of a parting board, with very little twilling, if any. The whole is put into action by the handle by means of cord transmission, and is supported on a common wooden framework.

The number of cocoons to each thread is highly variable ; down and wisps pass through with the thread ; the diameter of the latter is essentially variable ; it is frequently observed to split up, because the baves of which it is formed lack adhesive power. As the passage from the basin to the drum does not take long enough to allow the raw silk to get sufficiently dry, the coils of thread adhere to each other more less. This article can only be used locally or in China. Even in Indo-China, weavers must re-spool and calibrate it.

Thanks to the initiative of the Direction of Agriculture, a new type of basin and reel has been designed. Its price is very low and its construction very simple, but it possesses all the essential parts for improved spinning. Altready more than 400 basins of this type are at work in the region of Nam-Dinch ; 100 in that of Thai-Binh ; and as many in the other regions of Tonking. These appliances yield a silk which fetches on the spot from 8*s.* to 12*s.* 9*d.* per lb. and finds buyers in France, while the old rings are worth only 4*s.* to 4*s.* 9*d.* and are not utilisable by European industry. Steam spinning works have recently been installed at Phuphong (270 700 lbs. of cocoons consumed in 1911); at Nam-Dinh, and Bai-nih.

The Annamite workmen manufacture, on wooden looms, extremely varied fabrics : plain or figured silks, grenadines, gauzes, crepons, etc. Scouring and dyeing only take place after weaving. The pieces are nearly 9 yards in length. The figured work is about $^3/_4$ yard wide ; the other fabrics 12 to 16 in. The natives are unable to make any use of the waste : floss, wisps and pellicles.

The introduction of French worms into Indo-China has been several times attempted but without success : the worms perished from pébrine. Nevertheless, when properly reeled, Tonking silks rival those of Canton.

The Direction of Agriculture, Forests and Commerce has elaborated a methodical plan of action for increasing the quantity and quality of the silkworm production in Cochin China. A decree of 1904 exempted from taxation for five years all mulberry plantations. Model silkworm nurseries were constructed and model mulberry plantations annexed ; a model of the hurdle in use at Canton, cleaner than the Annamite straw hurdle, was put into use ; the selection of eggs on the Pasteur system was applied. An agreement was concluded in 1905, with a private company, for the annual supply of 3 000 000 selected layings, which are distributed free to Tonking silkworm breeders. An installation for industrial egg-production and an official station of silkworm investigation have been installed at Phulanthuong. This station comprises : a breeding nursery ; a laboratory

for the improvement of the richness in silk of the cocoons by the Coutagne process; model silkworm rearing houses and mulberry gardens for trials of acclimatisation of new breeds of worms and the selection of the mulberry tree.

Among other work, the Sericultural Station concerned itself with producing fresh strains by crossing the Annamitic breeds with other breeds of higher yield. Successful results have been obtained with a Chinese variety from the province of Canton, and a Japanese variety.

Model rearing-houses, egg-nurseries and an Investigating Station have been created in Annam; an egg-producing station has been established at Tan-Chau, province of Chaudoc, Cochin China; in Cambodia 200 000 selected egg broods are distributed per year.

To encourage competition of Indo-Chinese silk with foreign goods, a decree of the 28th. February 1909 established a premium in Tonking of about 9 *d.* per lb. of raw silk proving to possess really marketable properties, exported in bales of at least 220 lbs. for France, and originating from groups of at least 5 fire-heated basins.

1331 – Eri Silk.

MAXWELL-LEFROY, H. and GHOSH, C. C. *Memoirs of the Department of Agriculture in India*, Vol. IV, No. 1, 130 pp. + 9 plates. Calcutta, May 1912.

Eri (*Attacus ricini*) silk is a silk grown in Assam for local use, the fibre being spun, woven and worn by those who grow it. It is known as "Endi" and the woven cloth as "Endi" cloth. It is also exported to Europe for forming spun silk with the waste silk left after reeling other "reeled" silks.(1). The silk differs from other silks in that it cannot be reeled,

(1) Numerous species of Bombycidae and Saturnidae in India produce silk. They are divided into domesticated and wild, the former being the mulberry-feeding insects and the others the non-mulberry-feeding ones. The term "wild" is however applied to some that have for centuries been completely domesticated. The first family includes: *Bombyx arracanensis*, *B. crassi*, *B. fortunatus*, *B. mori*, *B. sinensis*, *B. textor*, *Ocinara diaphana*, *O. lactea*, *O. moorei*, *Theophila affinis*, *T. bengalensis*, *T. huttoni*, *T. religiosa*, *T. sherwilli*, *Trilocha albicollis*, *T cervina*, and *T. varians*. Especially the first genus, which includes domestic species, and particularly *B. mori*, is of great industrial importance. The family *Saturnidae* includes numerous so-called wild species, the principal of which are: *Actias ignescens*, *A. maenas*, *A. selene*, *Antheraea andamana*, *A. assama*, *A. frithii*, *A. helferi*, *A. mezankuri*, *A. nebulosa*, *A. paphia* *A. pernyi*, *A. perotteti*, *A. roylei*, *A. sivalika* (all these silks are called "tasar," though strictly speaking the name belongs to *A. paphia*; most of the silk imported into Europe is produced by *A. pernyi*), *A. yamamai* (which feeds on the leaves of *Ficus benjamina* and produces "muga" silk), *Attacus atlas*, *A. canningi*, *A. cynthia* (which feeds chiefly on *Ailanthus glandulosa* leaves and produces "muga" silk), *A. edwardsii*, *A. guernii*, *A. obscurus*, *A. ricini* (which produces "eri" silk), species of *Caligula*, *Cricula*, *Loepa*, *Neoris*, *Rinaca*, *Rhodia*, *Salassa*, *Saturnia*. Of the wild silks only "tasar," "eri" and "muga" have any industrial importance. GEORGE WATT. A Dictionary of the Economic Products of India, Vol. VI, Part III. London, 1893. (*Ed.*).

the cocoon is not formed of a long continous thread as in mulberry silk, but is spun by the worm in layers. The moth issues from the cocoon without softening or cutting the fibres, because one end of the cocoon is closed by loops of silk that nothing can get in, but the moth pushing from within can force its way out. Consequently it is not necessary to kill the insect in order to get the silk. Eri silk will probably be extended to other parts of India for cultivation on a small scale.

Rearing. — Eggs are obtained and kept in any vessel to which air can get, as a tray. In hot weather the trays should be covered with a damp cloth, in very cold weather similarly covered and placed in the sun. In hot weather the eggs hatch in seven days; in cold weather they may stay as long as 24 days.

When the worms hatch they are transferred to feeding trays which must also allow of the free circulation of air and be covered with a damp cloth during the day, and during very cold weather kept in the sun in the same way as the eggs. The general management of rearing is the same as that recommended for the common silkworm, with the exception of the food which in this case is the leaf of the castor plant. These worms do not climb before spinning their cocoons, but crawl to the edge of the tray; they must then be put on a layer of crumpled paper, or chips of dry leaves or dry straw on the bottom of a loosely woven basket, covered with the same material and other layers of worms and chips until the basket is quite full; a weight is then put on the lid or the basket is turned over. About 500 worms can be put into a basket 1 ½ feet in diameter. In rearing on a large scale a layer of dry mango leaves may be made on the floor for the reception of the mature worms.

The "Chandraki" or Spinning Frame of Bengal used for mulberry silk is successfully used, in damp weather, for the worms while spinning their cocoons, but it takes up too much space. Another method is to suspend cloth over horizontal bamboos, so that long folds hang down and to let the worms crawl into the folds to spin. Very clean cocoons can be got this way and they are readily detached from the cloth; also very little silk is wasted in the cocoon formation. The method requires less space and is useful in rearing on a large scale. After five days in hot weather, or eight in cold weather the cocoons are picked out and spread evenly on trays. After ten days in summer, or up to forty days or more in winter, moths come out. They are then placed in a covered basket; after 24 hours the males may be thrown away, and the females put into a separate basket in which they will lay eggs. The best eggs are laid the first night, usually about eighty by each female. A moth will lay 200 eggs as a rule. Those laid after the third night should not be kept. The empty cocoons, in ordinary practice, in Assam, are boiled in water in which a weight of castor ash equal to the weight of silk is dissolved, until the cocoons are soft

throughout. The Pusa Agricultural Research Institute reccomends the following method: soaking the cocoons in water for 18 hours, changing the water several times, then boiling in crystal soda, 25 % of the weight of the cocoons, for 45 minutes; or 12 % of mono-hydrated soda (2 oz. to 1 lb. of cocoons); common washing soda gives unsatisfactory results; then removing the cocoons and washing them; after which they are to be put into a hot soap solution (10 % of the weight of the silk) in which they may be boiled for a few minutes. Lastly the cocoons must be washed in running water or in several changes of water.

The soap may be omitted if the cocoons are not required very white. If on the contrary it is desired to make them very white, they should be treated with soap and after washing put for a few minutes into dilute sulphuric acid (½ per cent. in water).

The cocoons can be carded and spun like wool, or the silk may be spun directly from the cocoons which yield 5/8 to 3/4 of their weight of thread. Good cocoons after the moth has emerged, weigh about 1250 to the pound and small ones 1750 to 2000. And for each part in weight of cocoons about 75 of castor leaf is required.

Biological cycle. — The worm exists in several stages interrupted by moults. In the first of these its length is about 5 mm.; in the fifth it is from 95 to 100 mm. long. In the first stage all the worms present black spots on the back which in some remain during the successive stages while in others they disappear. In the last stage some are white with black spots, others yellow and again others greenish. Breeding separately each of these they may be obtained pure.

The worms secrete a white resinous substance which covers the entire surface of the body. The better the conditions of health and vigour of the worm the greater the quantity of this substance. The process of moulting lasts for 1 to 3 days according to temperature. The whole life cycle from the laying of the eggs to the flight of the moths varies from 37 to 85 days normally, according to the weather, but in the winter, a cold spell may bring the duration of a brood up to 100 days and over.

The Eri worms are polyvoltine, and rearing goes on all the year round; the period from June to February is the best. The worms spin two kinds of cocoons, *viz.* white and red-brown. The colour of the worms or the presence or absence of spots in them has nothing to do with the colour of the cocoon. A moth lays eggs from which both white and brown cocoons are formed, but if only the moths from white cocoons are bred, the red cocoons will gradually disappear and *vice versa*. Complete elimination can be effected so soon as in the third or fourth generation. White cocoons are preferred.

Experimental Work at Pusa. — Recently some experiments have been undertaken in crossing Eri silk moths, *Attacus ricini* Boisd., with A. *cynthia*

Drury, which is considered by some as the wild original form of the former. The crosses produced both white and red-brown cocoons.

From observations made at the Pusa Institute it appears that the mature worm weighs on average over 100 grains; when it spins there is a loss of 60 grains at once, probably mainly moisture from the skin but also from the silk and from exuvium at moulting. On 550 grains of leaf fed, about 200 is wasted and 200 is excrement. This has an importance in considering the manurial requirements of the castor crop, since if 80 cwt. of leaf were picked per acre, nearly 30 cwt. of leaf and as much of excrement would be available per acre to go back.

Of 645 grains fed to a worm, 336 were eaten, while the excrements weighed 214; for 100 000 worms these would work out respectively to 84 cwt. 44 cwt. and 28 cwt.

Seventeen successive broods were minutely observed at Pusa and records kept of the duration of the various stages, of the increase of weight in each, of the consumption of food, of the number of eggs laid. Numerous tables show the results.

The first brood was obtained from seven couples of moths hatched from Assam cocoons; it lasted from March 31 to May 14; it was healthy and did well. The second was from May 14 to about June 24. The cocoons were small but the worms and moths healthy. The third was from the end of June to August 10; about 5 per cent. of the moths failed to emerge from the cocoons and 3 per cent. died; the cocoons were larger. The fourth was reared in August and September; 40 per cent. of the worms died before the first moult, 3 per cent. when full grown and 2 per cent. failed to spin. The fifth brood went on into November; about 60 per cent. of the worms died from overcrowding and the difficulty of collecting food from a distance. The cocoons were smaller, whilst usually at this season they are larger. The next brood went through the cold months; to get eggs the cocoons were artificially kept warm; 12 per cent. of the eggs did not hatch out; only 50 per cent. of the worms in one lot spun up. The seventh brood was still worse, about 35 per cent. of cocoons being got in one lot and 50 per cent. in another. The weather was getting warmer with dry winds from the west. The next brood yielded 75 per cent. of cocoons but the produce of it was destroyed during the first stage by the hot westerly winds. In the ninth brood obtained from fresh eggs in July, 80 and 70 per cent. of cocoons were obtained; the tenth gave 80 per cent.; the next in September upwards of 75 per cent., and the following one in November-December only 50 per cent.

Labour for Rearing. — To produce about 205 lb. of pierced cocoons there have been necessary 950 coolie days including care of eggs, rearing of the worms, cleaning and sorting of cocoons and plucking leaves from plots near by.

Disease, influence of Climate, etc. — From the experience obtained at Pusa with the above-mentioned broods it appears that the low temperatures in winter (December, minimum in the forties, (6 to 10° C.) are the most serious difficulty in breeding. Temperatures above 105° F. (40½°C.) are also injurious, but more to the quality than to the output of the cocoons. The ideal conditions seem to lie between 60 and 90 (15° to 33° C.). A temperature of at least 60° F. and preferably 70°F. for three days is required when the worms are spinning or the moths emerging.

The flacherie in mulberry silkworms due to *Streptococci* and *Vibrios* from the mulberry leaves, as such does not exist in Eri. A disease of a similar nature connected perhaps with the castor leaf occurs in Eri. Mr. C. M. Hutchinson is at present investigating this disease which it is proposed to call " bacillar disease."

Pébrine and muscardine have also appeared among Eri, but hitherto have not assumed any real importance. The most important enemy is the parasitic *Tachinid* fly whose maggot lives in the worm and destroys it. This insect is at present limited in its distribution. As the eggs cannot carry this parasite, only eggs should be introduced to new localities, never cocoons. Bats and ants are destroyers of Eri, and in one case bats did some damage by feeding on the pupae. In general, up to now at least, with proper care and favourable climatic conditions, disease is not very important. For Eri also exchange of seed and renewal of the stock from some distant place is very advantageous ; the Pusa Station recommends breeders of different localities to exchange seed and as far as possible assists them for this purpose.

Treatment of Cocoons. — The Eri cocoon is composed of 1) the cradle, 2) a number of detachable layers, from three to seven, 3) an inner layer where the thread weakens off and is much covered and connected with gum. It is not possible therefore to reel this silk like mulberry silk. Besides, the gum of the Eri silk does not solidify again and join the fibres of several cocoons into one thread at the eye of the reeling machine. When the moth emerges from the cocoon it leaves behind it the empty pupal skin as well as the old dried caterpillar skin. If the cocoons are carded these remains are broken up and have to be removed by special methods. If the cocoons are spun, the inner layer gets wasted ; and if they are boiled much dirt comes out in the water and stains them.

It becomes thus desirable to clean the cocoons, and a machine has been invented by Mr. R. W. Coryton for the purpose. It pushes the closed end of the cocoon through the open end, thus turning the whole cocoon inside out. There are two machines, one a simple hand one, the other a more complex or power one. With these machines 30 to 60 cocoons per minute can be turned inside out and cleaned. When the cocoons have

been cleaned by this method they do not require to be repeatedly washed, the bleaching baths being sufficient.

Carding. — Boiled dry cocoons are readily carded by hand for hand-spinning and it may be desirable to do so where wool-carding and spinning are familiar to the pepople, but spinning can be done also directly from the cocoon either with the "Taku" or spindle or with the "Charka" or spinning wheel, or with the "continuous spinning machine" devised at Pusa. 100 parts in weight of dry cocoons, give 78 of dry cleaned cocoons, 70 of boiled cocoons, 65 of thread.

Weaving. — The threads produced by the above methods are woven in the usual way on the ordinary hand looms that weave cotton. The fineness and gloss of mulberry silk cannot be got, the cloth turned out is "écru" colour (as the threads become very dirty in the various processes of sizing, warping and weaving) and not adapted to dyeing in light shades.

The Eri thread can be bleached with "blankit," with hydrogen peroxide, or with sulphur fumes; the latter are also used for bleaching the cloth.

Dyeing. — Eri silk, as other silks, is readily dyed with a large range of colours. It has been shown that silk is a better material with which to use indigenous natural dyes than is cotton. The writer gives a short notice of the principal ones and of the methods followed in preparing and using them. His list includes: Sapan Wood or Bakam (*Caesalpinia Sappan*); Kusum-safflower (*Carthamus tinctorius*); Kamala (*Mallotus philippinensis*); Al (*Morinda tinctoria*); Singrahar (*Nyctanthes Arbor-tristis*); Manjista — Madder (*Rubia cordifolia*); Kantal — Jakwood (*Artocarpus integrifolia*); Annatto (*Bixa orellana*); Dhak (*Butea frondosa*); Hadi — Turmeric (*Curcuma longa*); Indigo — Nil (*Indigofera* sp.); Myrabolans (*Terminalia Chebula*), etc.

Among the dyes of animal origin, are to be mentioned the colouring matter extracted from the body of the lac-insect (*Tachardia lacca, T. albizziae, T. fici, T. decorella*, etc.) and those from the cochineal insects (*Coccus cacti* and *C. indicus*).

Lastly a list is given of the chemical dyes and of the methods followed in using them on Eri silk.

FISH

1332 - **The Hatching of the Eggs of the Goldfish (*Carassius auratus* L.).**

WINTERBERT, P. L'e Déterminisme de l'Eclosion chez le Cyprin doré (*Carassius auratus* L.). — *Comptes-Rendus hebdomadaires des Séances de la Société de Biologie*, Tome LXXII, No. 25, pp. 70-73. Paris, 12 juillet 1912.

After having studied the hatching of the eggs of trout(1), the Author undertook enquiries into the hatching of another of the Teleostei, the goldfish.

(1) *C. R. de la Société de Biologie*, Tome LXXII, No. 18, p. 799, 1912.

The wall of the egg of this latter comprises, in addition to the *zona radiata*, (membrane traversed by radiating canals, which is the only envelope of the trout's egg), a second external envelope, closely bound up with the *zona radiata*. The shell is however thinner and much more transparent than that of the trout.

During the time of incubation, which is, at 15° C., about 7 days, the eggs undergo no variation of volume. When the biological conditions are the same, the eggs often hatch within the space of a few hours. Under the action of the liquid secreted by the unicellular glands of the skin of the embryo, the shell grows thin and finally tears. In nature, the rending is accelerated by the active movements of the embryos. Nevertheless it may occur, both in the trout and the goldfish, in the absence of all voluntary movement of the larva, as is proved by the complete, although retarded, hatching of eggs placed in a solution of *chloretone* of 3 per 10 000, which renders motionless the embryos of the eggs placed in it.

FARM ENGINEERING.

1333 - **The Use of Wind-Power for the Production of Electricity.** AGRICULTURAL MACHINERY AND IMPLEMENTS

LIEBE, G. Die Verwendung der Windkraft für Erzeugung von Elektricität. — *Maschinenschau*, 10. Jahrgang, Nr. 13, pp. 152-154. Berlin, 1. Juli 1912.

The Technical High School of Dresden last year began experiments for the production of electrical energy by wind-power. For this purpose they erected a wind turbine and in connection therewith a small electricity plant.

The plant was so designed that it was entirely automatic and put into operation at low wind-pressures. The electrical machinery consists in the main of a dynamo and a set of accumulators, which are accommodated in a small house beneath the wind turbine. The electrical energy is used for lighting purposes.

The wind turbine transmits the power through a vertical shaft, which is conducted through the roof of the house beneath the turbine, to a belt pulley inside the house, from which the dynamo is driven. The latter is so designed that it adapts its number of revolutions to the loads varying in consequence of changing wind power. The electric current produced is conducted into the accumulators. The voltage of the battery is not regulated as usual by appliances with movable contacts but automatically by small iron wire resistances which are placed in front of the lamps, and ensure uniform light. A further important point is a newly designed switch between the dynamo and the accumulators, which automatically interrupts the connection between the two as soon as the voltage in the dynamo becomes less than that in the accumulators ; by this means the return flow of current from the battery into the dynamo is prevented when the

latter works at a low voltage owing to feeble wind. This switch operates exceedingly well.

The plant supplies electricity at a wind pressure of only 3 m. (10 ft.); according to the experience gained it can be left working in any velocity of wind, even at night time. It is now intended, by fitting automatic recording appliances and by measurements extending over a year, to determine how much electricity the plant can supply on the average.

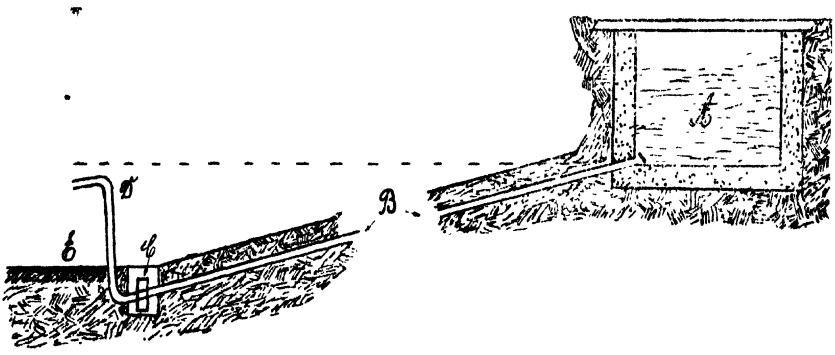
BUILDING-CONSTRUCTION

1334 – **Automatic Emptying of Liquid Manure Pits.**

SCHWIND. Selbsttätige Entleerung der Jauchegrube. — *Deutsche Landwirtschaftliche Presse*, XXXIX. Jahrgang. No. 55, p. 642. Berlin, 10. Juli 1912.

If a cowshed and the adjacent liquid manure pit are situated on a little rise, a system of pipes can with advantage be employed instead of a pump for the emptying of the pit.

The pipe must be fixed into the bottom of the pit, run obliquely



downwards into the ground and pass at the end into a perpendicular support with a horizontal discharge pipe.

In the accompanying diagram, A is the manure pit, B the pipe, C a cock, D the discharge support and E the place for the liquid-manure cart.

The discharge pipe of the support D must lie somewhat lower than the bottom of the manure pit; at the same time, it must be placed enough above E to allow of a manure cart being placed beneath it.

The pipes must be of cast iron and 2 inches inside diameter. They must be provided at their upper end with a sieve, in order that impurities may not find their way in. In order to prevent mud collecting in the pipe, the latter should be closed above by means of a simple lead slide, which is only raised during the emptying. In districts where there is any fear of the liquid freezing in winter in the pipes, the latter

must be capable of being emptied, in which case the lead slide should be replaced by a regular cock placed at the upper end.

By this arrangement, the work is much simplified, for the driver has only to place the cart under the pipe, open the valve C and close it when the barrel is full; further, the amount of work done in the day by a team is increased, for little time is lost in each filling of the barrel.

These advantages justify the expense incurred. The cost of the outfit with 110 yards of pipe works out as follows:

Excavating and closing the trenches, 110 yds. at about 9*d.* per yard	£ 4
Laying the pipes	» 1
One tap	» 1
Pipes, 110 yards at about 1*s.* 9*d.* per yard	» 9
Total	£ 15

RURAL ECONOMICS.

1335 – The Cost of Harvesting.

GIRARD, HENRI. Prix de revient de la moisson. — *Journal d'agriculture pratique*, 76ème Année, Tome II, No. 27, p. 18. Paris, 4 juillet 1912.

At the meeting of the 12th. June 1912, of the National Society of Agriculture of France, M. J. Bénard presented on behalf of M. Girard, a note on the cost price of the harvest in 1911, on a large farm in the environs of Paris. There were cut and brought in 175 acres of wheat and 111 acres of oats, altogether 286 acres.

The work of reaping, both by hand and by machine, lasted twenty days, from July 18 to August 6. The crop was got in in nine days from August 4 to 12. The harvesters did 124 days of work on 64 acres, each cutting and binding about half an acre a day. They earned £40 15*s.*, *i. e.* 6*s.* 6*d.* per day. The total cost of harvesting and binding by hand was £48 5*s.* 9*d.* or 15*s.* 1*d.* per acre. The self-binders and one reaper cut 222 acres, occupying 45 3/4 man-days, 89 3/4 horse-days and 37 ox-days. They cut on the average 6 acres per day, knocking off between 11 and 1 o'clock. Each machine cleared 52 acres, but one self-binder can easily do 75 acres. There are also 33 days of opening-up the fields with the scythe. The following is the cost of machine harvesting:

	£	s.	d.
1. Opening-up, 33 days	6	11	0
45 3/4 days machine-drivers	6	7	2
Premium for work done, 4d. per acre	3	11	6
Binding the scythe work, picking up the sheaves behind the machines, binding behind the reaper	15	11	10
2. 89 3/4 days horse work at 3s. 7d.	16	0	8
37 days oxen at 1s. 7½d.	3	0	2
3. Oil, upkeep and depreciation of 4 machines	31	15	0
(Machines at £33 15s. redeemed in 5 years, plus 24s. each for oil and spare parts)			
Twine, 5½lbs. per acre	18	16	4
Total	101	13	8

The cost per acre is thus 9s. 2d.

The following was the cost of carrying:

	£	s.	d.
1. Labour (19 labourers, foremen and bailiff) 10 days of work (being an average of 7s. 3d. per man per day).	74	4	0
2. 117 3/4 days of horses at 3s. 7d.	21	0	9
87 days of oxen at 1s. 7½d.	7	1	6
3. Day of rest, paid to workmen	2	16	4
„ „ „ for horses	2	17	2
„ „ „ for oxen	1	9	3
4. Sundry expenses.			
Thatching three stacks at 1s. 9½d. per 1000 sheaves	2	13	6
Straw, 300 bundles at 27s. 9d. per 100.	4	3	3
String and stakes.	1	4	0
Redemption of £913 for sheds in 20 years	40	13	0
Interest on the balance remaining to be redeemed at 5 %	42	16	6
Wine on the last day of harvest and sundry expenses	4	0	0
Total	£209	19	3

This gives a cost of 14s. 8d. per acre (over the 286 acres) for carrying the crop.

In all the harvest from the first to the last day cost therefore:

	£	s.	d.
Hand harvesting	48	5	9
Machine harvesting	101	13	8
Carrying.	209	19	3
Total	£359	18	8

The total expense per acre was 25s.

These figures are taken from accounts very well kept. The Author nevertheless remarks that it would evidently be wrong to generalise this

result, which is conditional upon the extent and character of the farm and above all the clemency of the weather, the work having been conducted without interruption in exceptionally good weather.

1336 – **The Law of the Decrease of Returns with the Increase of the Distance of the Fields from the Farm.**

BEINERT, A. Das Gesetz der sinkenden Rente bei steigender Entfernung der Felder vom Gutshofe in der landwirtschaftlichen Praxis. — *Kühn-Archiv*, Band 2., erster Halbband, pp. 1-145. Berlin, 1912.

This study is based exclusively on the account books of eight large farms entered at the " Association for Book-keeping on the Howard system " of Leipzig. These books refer to the agricultural year 1909-1910. The chief material is supplied by the auxiliary books, in which for each field of the farm, and for each crop account has been kept of the amount of time expended upon it both by the men and by the draught animals.

These data were in their turn again subdivided : In work debited to the different fields but carried out at the farm (loading of manure and unloading of cereals), in work which requires the distance from the field to the farm to be gone over twice (carriage of manure to the field, or of cereals to the threshing-floor) ; and in work which requires the same distance to be gone over four times (ploughing and seeding, subsequent cultivation and harvesting). Thus it has been possible to calculate how often the distance from the farm to each field had to be travelled over for the various operations of manuring, cultivating and harvesting the crops.

In calculating the time employed the following speed in travelling without a load was assumed :

Horses	1.05	metres	(3.43 ft,)	per sec.
Oxen	0.71	»	(2.13 ft.)	» »
Men	1.00	»	(3.28 ft.)	» »

The calculation of the loss of time due to distance was made, for horses oxen, men, women and children, by means of the formula : $\frac{D \cdot N}{V}$ in which D is the distance of the field, N the number of times that the distance was gone over and V the speed per second. The result was expressed by the writer for 10 hour's work.

Example :

$$\frac{D \cdot N}{V \cdot T} = P = \frac{3\,000 \cdot 24}{1 \cdot 36\,000} = 2 \text{ days}$$

in which $D = 3\,000$ metres ; $N = 24$; $V = 1$ metre per sec., and $T = 10$ hours.

(1) 1 metre = 3.2809 feet. (*Ed.*).

The writer, after an exhaustive review and bibliographical criticism of the subject and after having minutely described the eight farms, gives for each of them numerous tables in which numerical data are worked out for the single fields. He especially treats very minutely the many factors which in each farm have contributed to accentuate the inevitable oscillations inseparable from an investigation of this kind, which is based exclusively on data supplied by actual practice; these data either contain in themselves causes of error, or undergo the influence of so many factors of which no account can be kept in a purely theoretical examination of the problem.

For this reason the law of the decrease of returns with the increase of the distance from the farm, does not find in this investigation all the support from the figures collected that one would have been led to expect.

Nevertheless from the data collected in the annexed table the increase of expense in the carriage of manure with the increase of the distance is clearly seen. Here also, however, the increase is not always uniform and there are considerable oscillations, due to the kind of roads or to other general conditions of the farm.

In farms 1,5 and 8 the usefulness of some outlying building (Vorwerk) for the most distant fields appears evident.

It is worthy of notice that in this table, though dealing with well ordered and well managed large farms, the figures are much higher than those given by many writers for the transport of manure. Thus, for instance, Müller of Darmstadt gave the following figures:

¼	of an	hour	=	1093	yards	=	1s.	0 ½	d.	per ton.
½	»	»	=	2186	»	=	1s.	4 ¾	d.	» »
¾	»	»	=	3280	»	=	1s	10¼	d.	» »

Proceeding next to examine the various crops, the author examines the cultivation of sugar beets, potatoes, cereals, and forage crops and collects in tables the numerical data dealing with each.

From the examination of these figures it appears that in practice the influence of distance, if it has not been completely eliminated, has been sensibly reduced. This is in the first place due to the sense and personal ability of the farm manager.

The following are some of the facts that appear evident from these investigations.

That the growing of rye in the most distant fields has lent itself very well, among cereals, to resolve the problem of distance; it gives a fair profit even in relatively distant fields. Among forage crops lucerne and clover answer well, but best of all long grass leys, not so much from the breeder's point of view, for whom meadows and pastures near the farm may

present some advantages corresponding to special objects, but from the point of view of the saving of labour and especially considering the high prices of hay in connection with the price which is realised by its transformation into other products in the farm itself.

The practice of fallowing has also in certain cases proved useful, especially for heavy lands which for their distance could not have been profitably dressed with stable manure. In general, wherever the farm is not based upon fattening and milk stock, fallows may be advantageously practised.

Green manuring has also contributed to reduce the effect of distance. It is to be noted, however, that it causes an increase rather than a diminution of labour, considering the brief space of time in which the work has to be done.

Nevertheless in the most distant fields green manuring can almost replace fallowing, because considered as a crop by itself it does away with the harvest of one year in the rotation and may thus be an advantage.

What is most interesting to note is the intimate connection which evidently exists between the greater or less distance of the fields and the amount of working capital of the farm itself, in the sense that it is not to be considered as uniformly distributed on the whole area of the farm, but proportionately to the relative distance of the single fields; otherwise it would not be possible to have any profit on the cultivation of these fields.

In order to demonstrate that the connection between the value of the land and the distance from the farm is recognized in practice, the writer gives in the following table, the figures which give the price actually paid by farm No. 3 for some fields:

Area	Years in which the purchase was made	Distance of the field from the farm	Purchase price per acre
acres	—	yards	£ s.
27.28	1906	3179	
6.82	1906	3582	65 - 14 -
5.58	1906	2516	
3.70	1907	3118	86 - 18 -
8.41	1910	3008	86 - 18 -
5.25	1910	3118	86 - 18 -
24.70	1909	4595	71 - 2 -
8.65	1908	5716	53 - 4 -

From the foregoing the necessity is seen of debiting each field with a different rate of interest, considering the value of the field not only according to its distance from the farm, but also in relation to the working capital devoted to it.

Cost of carting manure according to distance of fields from farm buildings.

Distance of fields from farms: yards		No. 1		No. 2		No. 3		No. 4		No. 5		No. 6		No. 8		Remarks
		Total cost	Cost for journey only	Total cost	Cost for journey only	Total cost	Cost for journey only	Total cost	Cost for journey only	Total cost	Cost for journey only	Total cost	Cost for journey only	Total cost	Cost for journey only	
		s. d.	*s. d.*	*s. d.*	*s. d.*	*s. d.*	*s. d.*	*s. d.*	*s. d.*	*s. d.*	*s. d.*	*s. d.*	*s. d.*	*s. d.*	*s. d.*	
0–505	per ton	—	—	1 3½	— 2	—	—	—	—	—	—	—	—	1 2½	— 2	
	per cart	—	—	—	—	—	—	—	—	—	—	—	—	1 6	— 2¼	Cart of 24 cwt.
505–1009	per ton	1 6	— 3¼	1 7¼	— 3½	1 7¼	— 4½	1 7¾	— 3¼	1 4	— 3¼	1 7	— 3	1 1¼	— 2¾	
	per cart	2 2½	— 5	—	—	2 9	—	2 6¾	— 5	1 11½	— 5	—	—	1 4¼	— 3¼	
1009–1640	per ton	1 7¼	— 6¼	1 9¾	— 6½	2 2¾	— 4¾	2 1¾	— 7	2 3¼	— 5¾	1 7¾	— 5¾	1 3½	— 6½	
	per cart	2 5	— 3¾	—	—	3 6¾	—	3 2¼	—10¼	3 4	— 8½	—	—	1 6¾	— 7¾	
1640–2187	per ton	2 1½	— 8¼	1 9¾	— 8¼	1 9	— 6¾	3 1¾	—10	2 3	— 10½	1 6½	— 8¼	1 4	— 9¼	
	per cart	3 2¼	1 0	—	—	3 11½	—	4 7½	1 2¾	3 3¾	1 3½	—	—	1 7¾	— 11¼	

		s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	
2187–2734	per ton	2 0¼	— 10⁹/₁₆	1 11⅛	—10⅛	3 0½	—11³/₁₆	3 1	1 0¼	—	—	2 1	1 0½	1 7³/₁₆	— 11¼		
	per cart	2 11³/₁₆	1 3⁹/₁₆	—	—	5 1	—	4 6⅛	1 6	6 4⅛	1 2⁹/₁₆	—	—	2 0⅛	1 1³/₁₆		
2734–3281	per ton	2 8¼	1 0	3 9⅛	—10½	2 8³/₁₆	1 2	3 1³/₁₆	1 4⅛	Outlying 2 0³/₁₆	buildings — 11¼	2 1½	1 5½	Outlying 1 3³/₁₆	buildings — 11⅛		
	per cart	3 11⅛	1 5½	—	—	4 3½	—	4 7⁹/₁₆	2 0	3 0⅛	1 3½	—	—	1 7½	1 1³/₁₆		
3281–3828	per ton	Outlying 2 4¼	buildings — 9⁹/₁₆	3 2½	1 2³/₁₆	2 10½	1 5½	3 7½	1 7	3 0½	1 11	3 1⁹/₁₆	1 5½	Outlying 1 4½	buildings — 9		
	per cart	3 5³/₁₆	1 2½	—	—	5 5½	—	5 3³/₁₆	2 4	4 7	2 10	—	—	1 8	— 11¼		
3828–4374	per ton	Outlying 2 2¼	buildings — 7⁹/₁₆	—	—	2 10³/₁₆	1 10½	—	—	—	—	—	—	Outlying 3 1⁹/₁₆	buildings 1 1¼		
	per cart	3 2½	— 11½	—	—	4 2⅛	—	—	—	—	—	—	—	3 10¼	1 4½	Bullock carts	
4374–4921	per ton	Outlying 1 9½	buildings — 9	—	—	—	—	—	—	2 9	1 7½	—	—	Outlying 1 5½	buildings 1 6		
	per cart	2 10⁹/₁₆	1 1½	—	—	—	—	—	—	4 0½	2 4⁹/₁₆	—	—	1 9¼	1 10	Bullock carts	
4921–5468	per ton	—	—	—	—	2 1⅛	2 0	—	—	—	—	—	—	—	—		
	per cart	—	—	—	—	3 6³/₁₆	—	—	—	—	—	—	—	—	—		
5468–6015	per ton	—	—	—	—	2 5	2 1½	—	—	—	—	—	—	—	—		
	per cart	—	—	—	—	4 1	—	—	—	—	—	—	—	—	—		
6015–6562	per ton	—	—	—	—	2 2⅛	1 8³/₁₆	—	—	—	—	—	—	—	—		
	per cart	—	—	—	—	5 4⁹/₁₆	—	—	—	—	—	—	—	—	—		

This will facilitate also the resolution of the problem of establishing outlying buildings (Vorwerke) for the most distant fields, taking into account the greater value which they would thereby acquire. It always remains to be seen though whether it would not be more advantageous to rent them to neighbours or to sell them.

Lastly it is to be noted that the planting of orchards has often proved a profitable way of dealing with the distant fields, whilst in extreme cases forest trees have been used.

In the farms under examination the average distance of the fields from the farm was 1640 yards, with a maximum distance of 2842 yards; the distance from the railway or from the sugar beet factory was, on average, 1530 yards with a maximum of 7870 yards. The returns nevertheless are in general satisfactory.

The limits assigned by Werner for intensively cultivated farms, namely 1093 yards on first class soils and 820 yards on less fertile land, are thus considerably overstepped.

1337 – Valuation of the Financial Returns of a Farming Property on the Basis of the Gross Production.

LAUR, ERNEST. Die Schätzung des Ertragswertes von Landgütern nach dem Rohertrage des landwirtschaftlichen Betriebes. — *Archiv für exacte Wirtschaftsforschung*, Vierter Band, Zweites Heft, pp. 231-260. Jena, 1912.

The Author, after having dealt briefly with the empirical valuation and the rational valuation of farming properties, bringing into prominence the deficiencies of the former and the practical difficulties of the latter, proceeds to discuss the desirability of looking for those factors which, on the basis of the gross production of farm properties — a figure there is no difficulty in securing — will allow of determining with a sufficiently close approximation what are the financial returns of such property or the value of its positive revenues.

Well adapted to an investigation of this kind was the statistical material of the Swiss Peasants' Secretariate prepared with great care by the Author and his assistants, the more so as it already comprises more than a decade of investigations bearing on various groups of properties appertaining to different zones and having a different arrangement and direction of production.

The data supplied by the accounts kept by the farms registered in the Secretariate were therefore worked out on the basis of three principles:

1. The size of the farm.
2. The class of farm on the basis of system of cultivation.
3. The direction of production.

There were thus created no less than 2 500 groups of properties for the whole of Switzerland. Many of them find as yet no replica in the

material supplied by the account books of the farms registered in the Secretariate, but for fully 492 groups the factors in determining the value of yield were ascertained.

As we have already stated, this method of valuation is based on the gross production of the property. It will consequently be necessary to define what is meant by gross production. It is determined by calculating the following :

1. The receipts in money produced by the property during a financial year (including the increase of outstanding claims).
2. The supplies in kind by the farm to the family and the several industries or persons, etc.
3. Supplies of estate produce for the increase or maintenance of the capital invested.
4. Increase of inventory of wood stands and crops.
5. Increase of live stock.
6. Increase of the stock produced on the farm.

The purchase of cattle is of course deducted from the gross production and also the purchase of raw forage on a large scale; not so, concentrated foods and chemical fertilisers, which are regarded as closely bound up with the farm production. After the gross production of the farm and even of a single commune has been fixed, the operation is reduced to the application of the selected factor or factors. Where required to effect the valuation of the several fields of the estate, the Author suggests the following method, based on percentages of the average value, allowing for the productivity and relative position of the fields. This provides for the assessment of the returns value of the land only, allocating valuation points to the fields and dividing the value by the number of points. The sum representing the value of the plots plus the redeemable capital of the estate (improvements, buildings and plantations) thus coincides with the total value of yield.

We give below an example (1) :

Gross production	£400	($2 000)		
Factor : 5				
Value of yield			£2 000	($10 000)
Improvements	£ 80	($400)		
Buildings	£720	($3600)		
Capital in crops	£120	($600)		
Total			£920	($4600)
Yield of the land			£1 080	($5 400)

(1) The figures in this example are not calculated from the original ; throughout the rest of the article the calculations are made at 20.40 M. = £1, and $4.8665 = £1, or 1 M. = $0.23855.

The farm is 40 acres, so the average yield per acre is £27 ($135). Allotting points with 10 as the mean, we obtain, for instance :

Class I	10	acres :	15	points	= 150
Class II	20	acres :	10	points	= 200
Class III	4	acres :	8	points	= 32
Class IV	6	acres :	5	points	= 30
				Points . . .	412

Therefore a single point equals £1080 ($5 400) ÷ 412 = £2 12s. 5d. ($13.11).

We thus arrive at the following valuation :

Class I	£39– 6–3 ($196.65) per acre =	£393– 2–6 ($1 966.50)
Class II	£26– 4–2 ($131.10) per acre =	£524– 3–4 ($2 622.00)
Class III	£20–19–4 ($104.88) per acre =	£ 83–17–4 ($ 419.52)
Class IV	£13– 2–1 ($ 65.55) per acre =	£ 78–12–6 ($ 393.30)
Yield value of the land (approx.)		£1 080 ($5 400 —)
Values of other capital on the farm		£ 920 ($4 600 —)
Yield value of the farm		£2 000 ($10 000 —)

Let us now see within what limits these factors fluctuate, calculated on the basis of the returns of the properties registered in the Swiss Peasants' Secretariate.

The following Table (No. 1) gives us these fluctuations generally for the decade 1901-1910.

TABLE I-A. (U. S. Dollars).

Fluctuation of the " factor " from 1901 to 1910.

Year	Number of balance sheets examined	Labour expenses per acre	Total expenses per acre	Gross return per acre	Yield value per acre	Yield value per unit of gross return : « factor »
1901	110	19.88	31.46	38.77	95.08	2.45
1902	56	19.20	36.17	46.52	212.50	4.55
1903	145	25.93	37.12	49.65	267.86	5.40
1904	175	22.56	33.26	45.19	208.44	4.60
1905	204	22.09	36.75	48.77	251.36	5.15
1906	230	22.00	35 75	49.97	300.13	6.00
1907	250	22.23	34.91	50.77	311.52	6.15
1908	287	23.30	38.14	53.26	294.70	5.55
1909	276	24.96	41.16	54.76	255.33	4.65
1910	270	25.36	42.36	57.03	282.40	4.95

TABLE I-B. (£ sterling).

Fluctuation of the "factor" from 1901 to 1910.

Year	No. of balance sheets examined	Labour expenses per acre	Total expenses per acre	Gross return per acre	Yield value per acre	Yield value per unit of return: "factor"
		£ s. d.	£ s. d.	£ s. d.	£ s. d.	
1901	110	4 1 9	6 9 3	7 19 3	19 10 9	2.45
1902	56	3 18 10	7 8 7	9 11 2	43 13 5	4.55
1903	145	5 6 7	7 12 7	10 2 7	55 0 10	5.40
1904	175	4 12 9	6 16 8	9 5 8	53 2 1	4.60
1905	204	4 10 9	7 11 0	10 0 4	51 13 0	515
1906	230	4 10 5	7 6 11	10 5 4	61 13 5	6.00
1907	250	4 11 4	7 3 6	10 8 8	61 17 3	6.15
1908	287	4 15 9	7 16 9	10 18 10	60 11 1	5.55
1909	276	5 2 7	8 10 2	11 5 0	52 9 4	4.65
1910	270	5 4 3	8 14 1	11 14 4	58 0 4	4.95

Apart from the very bad agricultural year 1901, it will be seen that this factor undergoes no great fluctuations The years 1906 and 1907 are undoubtedly affected by the favourable influence of increased prices, but notwithstanding the considerable rise in gross production the factor remains fairly constant. This means that on the basis of past data factors may be determined possessing value for the future likewise — that it suffices to alter the figure of gross production or gross returns or yield, whatever the term used (Rohertrag) in order to arrive at the value of yield with fairly close approximation.

This being premised by way of generality, let us now see how this factor varies for the several properties in view of their extent.

This ratio is brought out clearly by the figures of Table II (p. 2072). It will be seen that the factor grows with the growth of the farm area. This is evidently due to the diminution of the gross production.

The larger farms are better adapted for producing a net return than small farms, which in their turn offer a better opening for the use of labour. The high gross return, or rather gross production (Rohertrag), involves heavier expenses for labour but not a larger net return. The reduction of the value of yield in the two minor classes of properties (cultivated farms) is undoubtedly due to the drawbacks of this form of property.

TABLE III.

Factor for determining the yield value in the various types of properties on the basis of the system of cultivation.

TYPE OF PROPERTY	Number of balance sheets examined	Gross returns per acre		Value of yield per acre		Yield value per unit of gross-returns: "factor"
		$	£ s. d.	$	£ s. d.	
1. Three-year rotation farms	390	46.39	9 10 8	199.64	41 0 5	4.30
2. Clover ley farms in Berne	172	47.55	9 15 5	245.75	50 7 0	5.15
3. Clover ley farms in Solothurn, Aargau and Baselland	92	49.70	10 4 3	258.11	53 0 8	5.20
4. Clover ley farms in Lucerne	83	53.20	10 18 8	387.94	79 14 3	7.30
5. Clover ley farms in French Switzerland	143	42.36	8 14 0	248.84	51 2 7	5.85
6. Clover ley farms in Geneva and Vaud (Bernese Type)	19	43.43	8 18 6	244.13	50 3 3	5.60
7. Jura farms, without pasture	48	31.91	6 11 1	153.31	31 9 1	4.80
8. Jura pasture farms	26	23.41	4 16 2	118.32	24 6 3	5.05
9. Highland farms in the centre of Switzerland	29	29.84	6 2 7	187.90	38 12 6	6.30
10. Grass farms with some arable land	204	40.94	10 5 3	226.91	46 12 6	4.55

11. Pure grass farms in German Switzerland on plain and hill.	115	57.55	11 16 6	252.39	51 17 2	4.40
12. Pure grass farms in the best fruit regions	66	56.45	11 12 0	587.43	120 14 1	10.40
13. Grass farms in Lucerne	34	52.00	10 13 8	383.61	78 16 6	7.40
14. Grass farms in French Switzerland	18	43.01	8 16 9	237.95	48 17 6	5.55
15. Grass-pasture farms of the St. Gall type	23	61.57	12 13 0	481.23	98 17 8	7.80
16. Pure grass farms in the Alpine valleys.	132	53.96	11 1 9	271.78	55 16 11	5.05
17. Alpine farms	65	27.80	5 14 3	89.90	18 9 5	3.25
18. Bünden and Valais farms.	63	41.00	8 9 6	79.63	16 7 2	1.95
19. Valais valley farms	20	56.13	11 10 8	314.87	64 14 2	5.60
20. Vine-growing properties in North-East Switzerland, with a considerable extent of farm crops.	44	66.77	13 14 4	311.90	64 1 10	4.65
21. Vine-growing properties in French Switzerland, with a considerable extent of farm crops	28	52.43	10 15 5	293.25	60 5 2	5.60
22. Grass with three-year rotation farms						
23. Three-year rotation with clover ley farms						
24. Grass and clover ley farms	119	53.36	10 19 4	288.93	59 7 5	5.40
25. Free farms						

Intermediate forms

TABLE II.

Area of the farms: acres	Number of balance sheets examined	Gross returns per acre		Value of yield per acre		Yield value per unit of gross returns: "factor"
		$	£ s. d.	$	£ s. d.	
7 ½ to 12 ½	230	64.44	13 4 10	214.36	44 1 0	3.30
12 ½ to 25	762	53.76	11 1 0	246.69	50 13 10	4.60
25 to 37 ½	467	45.70	9 7 9	258.86	53 3 9	5.65
37 ½ to 75	398	43.26	8 17 10	255.42	52 9 8	5.90
over 75	113	35.87	7 7 5	256.57	52 14 5	7.15

Expressing the factor of farms of 25 to 37½ acres as equal to 100, and using for the first two categories a higher factor, *i. e.* the average of factors of properties exceeding 25 acres, the ratio of factors for the five groups of farms will be as follows :

Farms of	7½	to 12½	acres:	58
Farms of	12½	to 25	acres:	81
Farms of	25	to 37½	acres:	100
Farms of	37½	to 75	acres:	104
Farms over		75	acres:	127

This gradation finds as yet no perfect counterpart in the farms of the several groups and sub-groups, many of which are still incomplete ; it is however probable that some types of properties, such as those employed for vine-growing, fruit-growing and cattle fattening, are less affected by the extent of the property.

The direction given to the production of the farm likewise influences the above factors ; this is made clear by table III, in which however the fertility of the different zones likewise finds expression ; and indeed it is interesting in this connection to note the close relation existing between the type of farm and the fertility of the zone ; thus the following groups of factors may be established :

Pure grass farms in the best fruit districts	10.4
Grass farms in Lucerne	7.4
Pasture farms (St. Gall type)	7.8
Clover-ley farms in Lucerne	7.5

The figures for clover-ley farms are also close together:

Canton of Berne	5.15
Solothurn, Aargau and Baselland	5.20
Intermediate forms	5.40
French Switzerland	5.85
Geneva and Vaud (Bernese type)	5.60

In French Switzerland the expenses are generally less, and the factor for an equal gross production is slightly higher. The grass farms likewise have factors which do not greatly vary from each other provided they are under like conditions of environment:

Grass-with-arable farms	4.55
Pure grass farms of German Switzerland on plain and hill	4.40
Pure grass farms of the Alpine valleys	5.05
Grass farms of French Switzerland	5.55

All of which proves that in the choice of the factor account must be taken not only of the fertility of the zone but also of the relations between the value of the produce and the labour account.

Let us now see the influence of the direction of production of the estate.

Table IV (next page) gives us these factors for 11 classes of farms.

In this case it is impossible to attribute to the graduation of the factors the same value as for the different types of farms on the basis of the system of cropping, because while the latter is principally influenced by the natural conditions of the locality the former is affected primarily by the variations of price of the produce. It is evidently easier to alter with profit the direction of production than the system of cropping. As the factors are intended above all to determine the value of the returns which can be anticipated at an early future, it will be necessary to allow for the variations of the groups of products on the markets because these may influence the factors themselves in so far as they depend on the direction of production. The graduation of factors must therefore be made in the first place according to the use of the farm and system of cropping and in the second according to the direction of production.

In addition to the use of the farm and system of cropping in relation to natural factors and direction of production, other conditions likewise influence the factors which determine the value of yield. It is therefore impossible to lay down *a priori* case by case the right factor, and it is a matter for the valuer to determine the gross production and apply the proper factor. By means of tables however the choice of this factor may be very much facilitated. For Switzerland, as will be seen from the material contained in an appendix to this work, there already exists sufficiently rich material in this department, which it is the desire of the Author to be able to complete usefully within a time which he hopes will be relatively short.

TABLE IV.

Factor for determining the value of yield according to the direction of production of the estate.

Direction of Production of the Estate	Number of balance sheets examined	Gross returns per acre				Value of yield per acre				Yield value per unit of gross returns: "factor"
		$	£	s.	d.	$	£	s.	d.	
1. Milk farms	899	52.43	10	15	5	302.31	62	2	5	5.75
(*a*) milk only	50	78.61	16	3	1	689.54	141	13	9	8.75
(*b*) milk with rearing	849	51.55	10	11	10	285.45	58	12	10	5.55
2. Cattle-rearing farms	185	38.71	7	19	1	139.06	28	11	5	3.60
3. Fattening farms	306	48.16	9	17	11	188.22	38	13	6	3.90
(*a*) calf fattening	60	60.52	12	8	9	325.53	66	17	10	5.40
(*b*) bullock fattening	35	39.52	8	2	5	111.60	22	18	8	2.80
(*c*) mixed cattle fattening	111	44.74	9	3	10	156.01	32	1	2	3.50
4. Farms with considerable pig rearing	8	70.56	14	19	11	253.91	52	3	5	3.60
5. Mixed farms	254	52.29	10	14	10	219.23	45	0	11	4.20
6. Arable farms	3	80.77	16	10	11	663.20	136	5	7	8.20
7. Cartage farms	2	92.56	19	0	5	673.97	138	9	10	7.30
8. Fruit farms	43	85.64	17	11	11	739.07	151	17	4	8.65
9. Vine farms	37	81.27	16	13	11	516.30	106	1	10	6.35
10. Woodland farms	2	15.58	3	4	0	65.85	13	10	7	4.20
11. Other farms	16	38.40	7	17	10	170.18	34	19	5	4.45

1338 – Cultivation Accounts. - Speculation Accounts.

Ricci, R. Conti culturali. Conti di speculazione. *L'Economia Rurale.* Torino, 25 luglio 1912.

Though in industries the economic ascertainment of the cost of production is arrived at without great complications, in agriculture it is too much to require this from bookkeeping pure and simple.

It is a mistake, and presents insurmountable difficulties in practice, to wish to include in bookkeeping, accounts of economic investigation in the wider sense of the word ; it is possible to arrive at a few limited deductions, but this is an operation requiring great care and none too simple.

Without going into the discussion of the reliability of cultivation accounts the Author gives the following summary statement for them :

CULTIVATION AND INDUSTRY.

DEBIT :		CREDIT :	
Land profit	*Lpr*	Balanced production	*P*
Expenses of production	*E*	Advances chargeable to the future	*A*
Industrial profit	*Ipr*		

in which *Lpr* represents the yield of the landed property, or what is the same thing, the quota of rent corresponding to the unit of area of that property worked or cultivated ; *E* represents the total of the expenses of production plus those of general character, including the allowance for direction, administration and supervision ; *Ipr* the interest on the capital advances represented by these expenses ; *P* represents the production secured ; and *A* the advance made for farming work which goes to benefit the future, or, where grass crops are in question, manuring, taken in the wide sense of fertilising substances and tillage together. Limiting his considerations to the cultivation account in connection with grass cultivation within a single unit of time, *viz.* a year, the Author observes that it is not desirable in the above investigation to stop at any results obtained for one year, but these results must be for a period of *n* years which as a whole represent all the possible variations of the negative or positive yields of cultivation, which in short represent the effective average obtained for these yields in the past and which presumably will be repeated, subject to a certain law, in the present and in the immediate future.

On balancing the cultivation account in question, that is to say making due repayment of the capital invested in farming, there will be obtained the normal case

$$Lpr + E + Ipr = P + A$$

The result obtained as regards *Lpr* and *Ipr* gives us the obtainable amount of the latter, and the result as regards *P* indicates the cost of production of the crops,

$$P = Lpr + E + Ipr - A$$

This is a very important merit of cultivation accounts except for the fact that, though it is true that *Lpr* and *Ipr* must result from a presumable average and must themselves represent the average, the same is not the case for the cost of production. In other industries the elements *Lpr*,*E* and *Ipr*, and the production secured are maintained almost constant for a fair number of years ; in agriculture however the first three factors likewise maintain some constancy, but the fourth, the quantity of product, varies within fairly wide limits from year to year, owing to a group of circumstances among which the most important are atmospheric vicissitudes.

From the same cultivation account it is not possible to secure the three objects ; the third might only emerge from a cultivation account based on data for the year in which it is compiled, an account which in many cases could likewise be conveniently inserted among other accounts of the ledger in a bookkeeping system tending towards analysis.

The first accounts, *i. e.* those made on averages, cannot be absolutely a matter for bookkeeping, but in rural economy are called *cultivation accounts* (colturali) ; the second account or accounts, based on figures of the year in progress, may, by way of exception, come within the bookkeeping limits (and this is often done) but much more properly are termed *speculation accounts* (conti di speculazione).

Speculation accounts may serve as a basis for cultivation accounts and the two many attain together the object which any other person engaged in industry finds in his accountancy.

The farmer, though not able to settle at once with as much facility of analysis as the manufacturer, the problems of his industry by the aid of bookkeeping, can, approximately at least, learn by this means the cost of production which is undoubtedly the thing which should interest him most.

The Author therefore gives the following complete diagrams of a speculation account for cultivation and one for an industry forming part of the ledger accounts.

CROP.

DEBIT:	CREDIT:
To *Advances for farming purposes*, the amount for manure and seeds applied to the land before opening the account. To *Stores* the value of the seed which has passed from the stores to the land. To *Cattle* the cost of the work supplied by labouring cattle. To *Labour* the cost incurred for work carried out. To *Machinery and implements* the quota for depreciation, upkeep and renewal. To *General expenses*, the quota including those of administration and supervision fairly divided over the crops and chargeable to this crop. To *Profit and loss*, the quota contributed by this crop for the due repayment of the land capital and crop capital.	By *Stores*, product obtained. By *By-products*, the amount of these, if any. By *Manures*, the amount of the organic remains in the stable which can be utilised. By *Farming advances*, the amount of chemical manures and tillage.

INDUSTRY.

DEBIT:	CREDIT:
To *Account supplying the raw material*, for the amount of the latter. To *Cash*, for purchase, if any, of other raw materials and fuel, etc. To *Labour*, for the work of workmen. To *Machines and implements*, allowance for depreciation, upkeep and renewal. To *General expenses*, the amount of these if any, plus those of administration and supervision. To *Profit and loss*, the quota attributable for due repayment of the land and agricultural capital.	By *Account receiving the product*, main and by-products. By *Manures*, value of the unsaleable by-products which can be used for the farm. By *Fertilisers and substances for agricultural use*, value of the unsaleable by-products which can be used for the farm.

The Author points out that there are many points to be discussed in these diagrams which might be summed up in one as follows:

CROP OR INDUSTRY.

DEBIT:	CREDIT:
To *Profit and loss*, amount $Lpr + Ipr$. To *Sundry*, amounts of E, expenses of cultivation, manipulation and general.	By *Sundry*, amounts of produce P. By *Advances*, amount A.

from which, as has been seen,

$$P = Lpr + Ipr + E - A,$$

which gives us the true cost of production for the current year. The Author always considered the case of balance between the debit and credit both of cultivation and speculation accounts, that is he assumed there is neither gain nor loss above or below a fair revenue to be allotted to the capital. The conclusions however would not be different if a deficiency or surplus were considered.

AGRICULTURAL INDUSTRIES.

INDUSTRIES DEPENDING ON ANIMAL PRODUCTS

1339 - **Pure Cultures or Acid Mixture as Additions to Rennet.**

BURRI. Reinkulturen oder Säuremischung beim Labansatz? *Schweizerische Milch-Zeitung*, 38. Jahrgang, No. 58 u. 60. Schaffhausen 19. u. 26. Juli 1912.

In the production of Emmenthal cheese the makers generally use a rennet that they prepare themselves from the stomachs of calves. In order to avoid the defects in cheese which are often due to the imperfect composition of the rennet, the writer has for the last five years recommended the addition of pure cultures of *Bacterium casei E.* to the rennet extract in order to prevent the development of injurious bacteria in the latter. The Swiss dairy Institute at Liebefeld-Berne prepares these pure cultures for cheese makers. 8 000 bottles of this preparation were used in 1910.

Recently a private firm recommends an " acid mixture " as an addition to rennet instead of the pure cultures. The dairy institute at Liebefeld-Berne has tested this preparation in its experimental cheese department. For the purpose of comparison some cheeses were also made with rennet to which pure cultures of bacteria were added and others with artificial rennet.

The curdled milk was often defective, and purposely defective calf stomachs were used for the preparation of rennet. Under these conditions faultless cheeses could not be made, not even with the addition of *Bact. casei E.* but the investigation showed that the cheese prepared with the " sour rennet " was inferior. In a later series of experiments the results of sour rennet were still more unfavourable. Its use produced cheeses with large cavities, while with the same milk artificial rennet made excellent cheeses, as was the case with the addition of *Bact. casei E.*

The " sour rennet " produced the worst cheese when its content of *Bact. casei E.* was low.

1340 - **The Co-operative Manufacture of Casein** (1).

DORNIC, P. La Fabrication coopérative de la Caséine. — *L'Industrie du Beurre*, 7e Année, Nos. 28 et 29, pp. 325-327, pp. 337-339. Niort, 14 et 21 juillet 1912.

Some ten years ago, co-operative dairy societies in Charente began to make use of skimmed milk for the manufacture of casein. This movement was assisted by the fact that the members did not take back the skimmed milk, the price of which was consequently exceedingly low. Hardly ½*d.* a gallon was realised for the skimmed milk and sometimes there was no demand for it. Though the production of casein may not be essential where skimmed milk fetches a good price, on the other hand it presents considerable advantages in the opposite case: the milk of the farm is industrially utilised and the maximum revenue derived from it.

Just as there were difficulties about returning the skimmed milk to members, so there will be difficulty in giving them back the residue of casein manufacture, the whey. In point of fact, when a co-operative society undertakes this branch of manufacture, the whey can best be utilised in a pig house annexed to the casein factory. This would, it is true, involve some danger by reason of pig diseases, but hygiene and good feeding may obviate this.

The first co-operative society in Charente which undertook the manufacture of casein, the society of Aigrefeuille-d'-Aunis, built a drying shed for a daily treatment of 1750 to 2000 gallons of milk, and the expense, for the construction of the buildings and the plant, did not exceed £800.

The small society at Sainte-Soulle, the members of which previously made use of skimmed milk for rearing porkers, has also begun the manufacture of casein. From the 1st. June 1911 to the 31st. May 1912, it dealt with 366 600 gallons of milk, which yielded 114 185 lbs. of casein. The yield of casein fluctuated about an average of 3 lbs. for 10 gallons of milk; the expenses were 4*s.* 1*d.* to 5*s.* 10*d.* per 100 lbs. of casein (average 4*s.* 11*d.*), according to the quantity of milk treated. The casein fetched 37*s.* 9*d.* per 100 lbs. and thus the dairy received 1 ¼*d.* per gallon of skimmed milk. The members were paid ⅝ *d.* per gallon of skimmed milk till the time when the whey was used in the pig-sties of the co-operative society, and ⅞ *d.* afterwards. The difference was used for redemption, and in this way the above small society found the means to reduce its debt by £890.

1341 - **Apparatus for the Preparation of Ozone in the Cold Storage Rooms of Abattoirs.** MEAT-INDUSTRY

BRANDT. Ozonanlagen in Schlachthofkühlhäusern. — *Deutsche Schlacht-und Viehhof-Zeitung*, 12 Jahrgang, No. 28, pp. 432-434. Berlin, 14. Juli 1912.

The temperature in slaughter-house cold-storage rooms can be

(1) See *B.* Jan. 1912, No. 202. (*Ed.*).

considerably raised for some time through the doors being left open during work, or through a large quantity of fresh meat being introduced.

This favours the development of microorganisms, which diminish the keeping property of the meat. For this reason, the destruction of these microorganisms by means of ozonizing the air in the cold-storage rooms has been instituted.

The first attempts in this direction were made by the firm of Siemens and Halske of Berlin in the abattoir at Cologne.

An already condemned calf's carcass, which was turning putrid and covered with myxomycetes, was chosen for the experiment, together with a quarter of an adult animal.

Both were placed in a small cold-storage chamber, which was supplied during three days with 5 gr. of ozone. At the end of this time, the myxomycetes had disappeared from the carcass of the calf and putrefaction was arrested. The flesh of the ox-quarter had not undergone any change, nor had its taste suffered in any way.

In the cold-storage rooms of the Potsdam abattoir, 92 germs of microorganisms were exposed for 1 ¼ hour on a plate with a suitable nutritive medium. After 12 gr. of ozone had been liberated per hour into the air of the cold-storage chamber, the plate showed only 4 germs.

Experiments have also been made in the use of ozone for the purpose of suppressing disagreeable odours. According to Erlandsen and Schwarz, such odours are not perceptible in air containing ozone; they are, however, only concealed by the latter, not removed. Ammonia and sulphuretted hydrogen in confined spaces were not perceptibly oxidised by ozone, although there was sufficient of the latter substance present to theoretically bring about complete oxidation.

Ozone is obtained on a large scale by Prof. Schwarz's electric spark system, or better, by means of spark discharges. The discharges take place in a so-called ozone generator; the latter consists of a metal pole (inner pole) which is surrounded, at a short distance, by a glass-cylinder. The glass-cylinder is kept cool externally by a spray of water, which in connection with the case of the apparatus represents an external pole. Between the two poles, the discharge of sparks takes place. The air to be ozonised is driven through the glass-cylinder.

So far, apparatus for the preparation and diffusion of ozone have been set up in the abattoirs of Cologne, Potsdam, Brandenburg, Berlin, Frankfort-on-Maine, Düsseldorf, Freiburg in Silesia, Aix-la-Chapelle, Erfurt, in the private cold-storage depot " Berlin-Zentrum " and in a cold-storage depôt in Hamburg, as well as in dairies and poultry and game stores. They are also employed in the fish industry.

The cost of the use of ozone is small. In the cold-storage depôt of the Brandenburg abattoir, the apparatus works for 4 to 5 hours daily after the last consignment of meat is brought in. The total expense is 10s. to 11s. per month.

INDUSTRIES DEPENDING ON PLANT PRODUCTS

1342 - **The Sugar Industry in Peru.**

Die Landwirtschaft Perus mit besonderer Berücksichtigung des Zuckerrohranbaus. — Bericht des Handelsverständigen bei der K. Gesandschaft in Lima vom 8. Februar 1912 veröff. in den Berichten über "Handel und Industrie." — *Die Deutschen Zuckerindustrie*, XXXVII, Nr. 28, pp. 612-613. Berlin, 12. Juli 1912.

From the agricultural economics standpoint Peru may be divided into the three following zones:

1. Coast zone, including the low-lying valleys on the Pacific slope of the Andes.

2. The "Sierra."

3. The "Montaña."

For the production of cane-sugar the coast zone, which is of a markedly tropical character, is of the chief importance; in the other zones sugar-cane is used only for the production of brandy and spirits, and has no importance for exportation.

Sugar-cane for sugar manufacture is grown in the following regions of the coast zone:

1. Littoral province of Tumbez: valley of the river Tumbez; port of export, Tumbez; local cultivation on a small scale.

2. Department of Lambayeque: valleys of the rivers Lambayeque, Saña and Eten.

3. Department of Libertad:

a) Province of Pacasmayo: valley of the river Jequetepeque; port, Pacasmayo; production of spirits and "chancaca."

b) Province of Trujillo: valley of Chicana and Santa Catalina; ports, Salaverry and Huanchaco.

4. Department of Ancachs, province of Santa; ports, Chimbote and Samanco.

5. Department of Lima:

a) Province of Chancay; ports, Supe and Huacho.

b) Province of Lima: valleys of Carabayo (lower and upper), Lurigancho and middle Surco; small plantations.

c) Province of Cañete; port, Cerro Azul.

6. Department of Ica: provinces of Chinca and Pisco; ports, Tambo de Mora and Pisco.

7. Department of Arequipa: valley of Tambo (south of Mollendo).

8. The Chilian provinces, formerly Peruvian, of Tacna and Arica.

The chief sugar-production of Peru consists of what is called exportation sugar:

1. "Granulada" or "Azùcar No. 1," Dutch standard ("Hollandsche Standaard") No. 16: this is the first product, crude crystallized sugar of pale brown colour.

2. "Moscabada," "Azùcar No. 2: pale brown crystals smaller than No. 1.

3. "Moscabada," "Azùcar No. 3": small dark-brown crystals.

4. "Moscabada," "Azùcar No. 4": similar to last.

5. "Azùcar blanco," white sugar.,

6. Rum, spirit at 30° Cartier (78 % at 15°C.).

7. Spirit at 40° Cartier (95 % at 15° C.).

Numerous small or moderate-sized plantations also produce:

1. "Chancaca," an impurified product obtained by simple crystallisation not in a vacuum-pan; used in the preparation of "chica" (a kind of beer based on maize), to encourage fermentation and give colour; also for use as it is.

2. "Concreto," like 1, but not clarified and consequently still more impure.

3. Rum.

The exportation of sugar from Peru has been as follows (in English tons):

1896, 70 602; 1897, 103 797; 1898, 104 043; 1899, 102 067; 1900, 110 449; 1901, 112 826; 1902, 115 507; 1903, 125 656; 1904, 129 872; 1905, 132 113; 1906, 134 569; 1907, 108 867; 1908, 122 919; 1909, 123 370; 1910, 119 722; 1911, (estimated) 138 000. The exported sugar goes chiefly to Chile (in 1909, 661 204 sacks of gross weight 227 lbs.), next to England (in 1909, 351 285 sacks), and then to the United States (in 1909, 95 590 sacks), and in varying amounts to Argentine, Ecuador, Panama, Barbados, Japan, France, Germany and Italy.

The following figures for 1907 to 1909 show the values of the different products exported.:

	1907		1908		1909	
	tons	£	tons	£	tons	£
White sugar	4 646	70 813	3 825	60 064	4 298	74 336
"Granulada" . . .	85 410	663 853	97 531	835 399	97 861	935 176
"Moscabada" . . .	17 367	88 229	20 533	146 041	19 479	138 545
"Chancaca"	1 444	4 403	1 029	6 227	1 689	11 441
"Concreto"	—	—	—	—	44	402

The "granulada" sugar mostly goes to Chile for refining, the rest to Liverpool and New York, to the latter as "tobacconist's sugar;" this is required to be of a specially dark colour and high polarization (at least

97 %) for use in chewing-tobacco. " Granulada, azùcar No. 1 " is quoted on a polarization value of 96 %, with compensation of 1½*d.* for every degree above, and deduction of 3*d.* for every degree below. " Moscabada, azùcar No. 2 " is sold chiefly at Liverpool and Greenock, on the basis of 80 % polarization, with a difference of 1½*d.* per degree above or below. " Moscabada, azùcar No. 3 " and " No. 4 " go to London, " No. 4 " being used in the preparation of porter. The " chancaca " goes to Chile, Bolivia and Ecuador for the preparation of " chica." Lastly, 40 % spirit is largely exported to Bolivia.

Peru has an ideal climate for cane, which will grow all the year round. The chief problem is that of irrigation, for which the streams from the Andes are employed.

Of still more importance for the refining, is the question of capital; local capital lacks initiative and the majority of the industry is in the hands of big capitalists, often foreigners. Nevertheless sugar-cane in Peru is more paying than either cotton or rice. Owing to the good prices lately, the developing industry has shown progress and is becoming modernised. In the last few years some attention has been given to manuring, but to a very limited extent, as the guano produced in the country is all exported.

Lastly, on the internal consumption, reckoned at 25 000 tons a year, the following duties are levied :

	General	« Sierra » and « Montaña »
	centavos per kg.	
a) " Granulada " and " azùcar blanco " . .	4	3
b) " Moscabada " and " concreto "	2	1.5
c) " Chancaca "	1	0.75

1343 - **The Effects of Drought on the Composition of Wines.** WINE-MAKING

HUGUES, E. Les Effets de la Sécheresse sur la Composition des Vins, *Annales des Falsifications*, Ve Année, No. 45, pp. 350-353. Paris, juillet 1912.

The grape only ripens normally, and is consequently normal in composition too, if the weather conditions of the year have not been distinguished either by excessive drought or excessive moisture. Experiments, now dating back some time, by M. Müntz, proved in this connection that irrigation in proper time favourably modified not only the quantity but likewise the quality of the grape.

The year 1911 having been marked by intense drought, the Author was led to examine how the effects of this drought had modified the composition of wines from non-irrigated vines. The two specimens of wine analysed were vinified in the laboratory, the one with grape gathered exclusively on stocks which had visibly been affected by the want of water in the soil, and the other with normal crop. The said grape originated

from two lots gathered on the same day from the same vineyard plot, some parts of which, with shallower soil, had been a good deal affected, while others with deeper soil showed no symptom of suffering whatever. The yield per acre of the first lot was 7160 lbs. and of the second 23 040 lbs. In both cases the grape was the Aramon, and the percentage composition in strigs and grapes was as follows :

	First lot	Second lot
Strigs	14.40	4.80
Grapes	85.60	95.20

The analysis of the wines, postponed till April in order to allow of winter defæcation, gave the following results :

TABLE I.

Measured constituents	No. 1 Wine from grapes affected by drought	No. 2 Wine from grapes ripening normally
Alcohol, volume % Distilled	8.6	9.6
Dry extract at 100° C. (gr. per litre)	28.80	18.50
Ash	2 35	2.05
Alkalinity of ash in potassium carbonate	1.13	1.27
Total acidity expressed as sulphuric acid	7.80	4.50
Volatile acidity.	1.00	0 70
Reducing substance expressed as glucose, ...	3.85	— 1.0
Potassium sulphate	1.0	— 1 0
Cream of tartar.	4.38	3.82
Uncombined tartaric acid	3.00	0.60

It follows from the figures contained in Table 1 that the constituents measured vary in noteworthy proportions in the two wines analysed.

In ordinary practice, no sorting out of those grapes which have suffered is done, to convert them into wine separately ; the entire crop is harvested. But on estates which owing to their situation have suffered severely, wines must be found presenting the same characters as the experimental wine analysed above, although in a less pronounced degree. Wines from properties so located as to have felt the drought, vinified on a large scale and analysed in April, gave the following results :

TABLE II.

Measured constituents		Red wine St. Mathieu de Tréviers (Hérault)	Red wine Montpellier	Red wine Lauret (Hérault)	Red wine Montpellier
Alcohol, volume % distilled		9.5	9.4	9.0	8.8
Dry extract	(gr. per litre)	25.15	22.80	23.15	21.25
Ash	„	2.50	2.30	2 35	2.40
Alkalinity of ash in potassium carbonate	„	1.34	1.38	1 41	1.27
Total acidity expressed as sulphuric acid	„	5.50	5.00	4 80	5.00
Volatile acidity	„	1.50	0.50	0.80	0.95
Reducing substance expressed as glucose	„	1.25	1.0	1.10	1.0
Potassium sulphate	„	1.0	— 1.0	— 1.0	— 1.0
Cream of tartar	„	3.10	3.57	3.38	3.57
Uncombined tartaric acid	„	1.95	1.60	1.20	0.90
Ratio of alcohol to reduced extract	„	3.2	3.4	3.2	3.3

In these analyses the same characteristics are found as in experimental wine No. 1, that is : relatively high dry extract, total acidity also high and above all the presence of uncombined tartaric acid in considerable quantity.

1344 - **Ammonium Carbonate in Wine-making.**

MENSIO, C. Il carbonato ammonico nella Vinificazione. *Le Stazioni Sperimentali Italiane.* Vol. XLV, Fasc. 5-6, pp. 381-432. Modena, 1912.

The Author has, in his previous investigations, shown that nitrogenous substances are true regulators of fermentation in wine. In this paper he studies the action of ammoniacal salts, to ascertain whether, and under what conditions, their use is advisable, and what effects they produce.

After a long historical exposition of all that has been done in relation hereto and the question of the relations between nitrogen and ferment, from which exposition it results that the question of the use of ammoniacal salts in wine-making is anything but solved, the Author passes on to describe the experiments carried out on musts obtained in different ways but all originating from Piedmont grapes.

The method of conducting the experiments consists in subjecting a given quantity of must (300 to 500 cc.) to fermentation in a glass vessel of suitable capacity, which can be shut off with a cover containing sulphuric acid as the sealing liquid, allowing the carbon dioxide to emerge, but preventing the evaporation of the liquid.

The substances to be tried, according to the case, are then put into the recipients, and are kept in thermostats or in a steam bath at 25°-26° C. The daily reduction in weight indicates the carbon dioxide which is formed in the fermenting process, from which is inferred the intensity of the progress of fermentation. Among the various ammoniacal salts ammonium carbonate was chosen because it does not convey any other elements be-

sides nitrogen into the wine. The doses of ammonium carbonate used range from 20 to 80 gr. per hectolitre.

In examining the results of the fermentation of 26 musts originating from various vines and differently obtained (which results are set out in a number of tables), the influence exerted by the method of pressing the grapes on the composition and the course of fermentation of the musts becomes evident. A special study of this question with two sets of experiments made it clear that the method of pressing the grapes is of great importance both as regards the substances in suspension and, in point of fact, as to the substances which pass into the musts in solution. When it is desired to prepare wines which are to remain sweet, there is every reason for not carrying the pressing process to its full limit. This, needless to say, applies to the vinification of musts separately from the lees, as otherwise in ordinary wine-making the long continuance of the lees in the fermenting liquid enables the nitrogenous compounds of the pulp, the skins, etc., to spread through the surrounding liquid.

The Author, while engaging to investigate how this utilisation of the nitrogen contained in the substances in suspension or attached to the skins takes place, whether it is by the operation of the ferment or by the action of some enzyme of the grape, at present reports on other experiments; as to the action of ammonium carbonate in secondary fermentation, he finds that with musts poor or rich in nitrogen, with sweet wines or dry wines sweetened with sugar, ammonium carbonate always promoted fermentation. He further studies the action of ammonium carbonate on diluted musts, on the different ferments, and on the nitrogenous substances remaining in the wine after fermentation.

From the whole of these studies the Author arrives at the following general conclusions:

1. That the importance of the nitrogenous substances in musts and wines is considerable, and that operations which may cause a variation in the contents of such substances also exercise marked effects on the behaviour of wines and musts.

2. That among these causes must likewise be reckoned the method of pressing the grapes, as it is possible to obtain, from a single mass of grapes, musts with very different nitrogenous contents and consequently presenting a very different course of fermentation.

3. That among Italian musts there are some so poor in nitrogen that they cannot ferment completely.

4. That ammonium carbonate certainly exerted a favourable effect on the progress of fermentation, represented by an acceleration of the course of fermentation in those musts which are so rich in natural nitrogen that they can ferment of themselves until complete decomposition of the sugar.

It gives a more rapid and much more complete fermentation in all the musts which are so poor in nitrogen that they can only ferment incompletely.

5. That in the secondary fermentation of wines to which sugar has been added, the ammonium carbonate has exhibited a favourable efficacy equal to that exerted in musts.

6. That in the case of dilution of a must with sugar water, the ammonium carbonate was able to take the place of the natural nitrogen of the must, behaving like asparagin as regards the effects of nutrition.

7. That all the ferments studied were able to avail themselves of the nitrogen of ammonium carbonate for their development.

8. That in one single case ammonium carbonate exerted an exceedingly slight depressing action on fermentation.

9. That an addition of ammonium carbonate in wine-making raises the contents of nitrogen in the resulting wines ; therefore the wines can present a better and more abundant nutritive medium to the ferments in their subsequent developments, and therefore, by analogy, to the other micro-organisms which effect the transformation and maturing of wines.

10. That ammonium carbonate must be given preference over other ammonium salts because, besides nitrogen, it conveys no foreign substances into the wine and does not produce any arrest of fermentation.

11. That he finds it desirable that ammonium carbonate should be included among the products allowed by the law against adulteration in wine manufacture and trade, because its employment, if carried out with proper precautions, may render useful service to the science of wine-making.

12. That the doses of carbonate to be employed may not exceed 30 grams per hectolitre.

The Author finally believes himself able to deduce from his studies a few considerations of a practical character in relation to the nitrogenous substances in wines and the action of ammonium carbonate.

As it is not possible straightway to distinguish in practice between musts rich and poor in nitrogen respectively, it is necessary, before adding the ammoniacal salts, to examine the conditions in which the fermentation of the musts take place. The greatest influence on the course and result of fermentation is exercised by temperature and aeration. With regard to temperature, two extremes may occur : too high in the South and too low in the North. Now, it is necessary to make an absolute distinction between cases of these two fermentations, which may turn out incomplete owing to opposite causes. In wine-making at low initial temperatures, ammonium carbonate may produce appreciable advantages, while in the case of high initial temperatures it would produce injurious effects. Therefore the temperature of the musts in fermentation is regulated first of all, and likewise the aeration, ammonium salts being only resorted to when the fermentation remains incomplete.

It may render exceedingly useful service in two cases in particular:

1. In the vinification of musts alone separate from the lees, skins and stalks.

2. In the vinification of very sugary grapes, produced by old and poorly manured vineyards, especially in dry years, in which the activity of the roots is largely reduced and therefore the quantity of nitrogen in the musts is smaller.

Finally, it is useful, when amonium carbonate is employed, to aerate the must at least a couple of times in order to make the multiplication of the ferment more active, so as to consume the greatest possible quantity of nitrogen.

1345 - **Influence of Certain Factors and especially Calcium Salts on the Ageing of Wines in the Presence of Ferments.**

KAYSER, E. and DEMOLON, A. Influence de quelques facteurs et notamment des sels de chaux sur le vieillissement des vins en présence de levure. — *Revue de Viticulture*, 19e Année, Tome XXXVIII, No. 970, pp. 65-69. Paris, 18 juillet 1912.

The Authors in previous works clearly brought out the profound changes undergone by wines which age in contact with the ferment. They in particular pointed out the preponderating influence of conditions of aeration and likewise the function of the description of ferment. In the present study they set themselves the task of ascertaining whether calcium salts, either modifiying the constitution of the wines owing to the effect of the nature of the soil, or through their influence on the biological properties of the ferments, are capable of exerting any action whatever on the constitution of brandies obtained by distillation of wines which had undergone contact with the ferment.

The investigations were carried out on two wines originating from the same grape, the Folle Blanche, grown in two entirely different soils in the regions of Cognac and Poitiers. The soil of Cognac is a stony loam containing about one hundredth part of the lime-content of the Cognac one. Thus the effect of the lime-content of the soil on the composition of the wines was studied. The study of the function of calcium salts on the constitution of brandies and the action of ferments in their relations to the composition of wines, was conducted by comparative experiments, the Cognac and the Poitiers ferments being grown in nutritive media free from calcium or prepared with various calcium salts, and these ferments being afterwards put into glass bulbs containing Cognac and Poitiers wines.

The conclusions arrived at by the Authors are the following:

1. These wines placed under aseptic conditions with moderate aeration, supply brandies of a lower Saval strength. The fact is due to a reduction of the higher alcohols.

2. The richness of the soil in lime has no noteworthy influence on the contents of calcium salts in the wine.

3. The fact of the ferments in their successive passages growing richer in calcium does not modify their properties in so far as regards the formation of volatile products.

4. The different races of ferment possess in exceedingly varying degrees the power of acting on a given wine. Infections, however small, cause a change in the phenomena.

1346 - Enquiries into the Vitality of Ferments.

GAYON, U. and DUBOURG, E. Recherches sur la vitalité des levures. — *Revue de Viticulture*, 19e Année, No. 968, pp. 4-7. Paris, 4 juillet 1912.

The microscopical examination of the sediment from an old bottled wine brought to light a few hyaline ferment-cells with every appearance of young organisms. Some drops of the sediment sown in a nutritive saccharine medium gave rise to a characteristic alcoholic fermentation. To the Authors this suggested investigations into the vitality of ferments, which were carried out on specimens of wines of Château-Lafite dating back to 1789 and distributed throughout the following years as far as 1848; in all, 13 specimens of high value, which, for that very reason, it was not possible to subject to chemical analysis.

The microscopical examination of the sediments and their cultivation in nutritive saccharine media showed clearly that in four bottles, in which the neck was empty, and which dated from 1803, 1810, 1826 and 1832, the cells of the ferment have reproduced themselves; and that these rejuvenated ferments produce alcoholic fermentation in flasks filled with sugar water prepared for the purpose. The mechanism of the vitality of these organisms may be explained as follows: a few ferment-cells are carried along with the wine when the latter is bottled and, by using the air which gradually diffuses through the cork, this ferment slowly reproduces, giving rise to the successive generations which ensure the permanence of living cells.

The relatively frequent occurrence of late fermentation of sweet wines in bottle, and the observed fact that in these cases the sediment is as it were accumulared in the neck of the bottle, in the neighbourhood of the cork, are evident proof of this penetration of oxygen through the cork.

The observations reported above may be summed up in these two conclusions:

1. It is possible, after a century, to regenerate the ferments originating from wines in bottles and into which oxygen has been able to make its way.

2. This penetration of oxygen occasionally becomes evident in certain white, sweet wines. The ferment, which reproduces in contact with the cork, may become so abundant as to give rise to a dangerous fermentation when the free sulphurous acid introduced into the wines through the sulphuring match is not sufficient in quantity.

PLANT DISEASES.

GENERAL INFORMATION

STATIONS FOR PLANT PATHOLOGY AND AGRICULTURAL ENTOMOLOGY

1347 – **Plant and Seed Disinfecting Station at Algiers.**

La désinfection des Végétaux vivants et des Graines à leur entrée en Algérie. — *Bulletin Agricole de l'Algérie et de la Tunisie*, 18e Année, No. 9, p. 218. Alger, 1er mai 1912.

In accordance with its decree dated January 25, 1909, the Government of Algeria has established at Algiers, under the direction of the Phylloxera department, a Station for the disinfection of plants imported from French departments on the Mediterranean coast and from Corsica, and plants of foreign importation. The Station comprises two chambers, each of 880 cubic feet capacity and capable therefore of containing fairly large consignments of trees. The disinfection of the plants is effected by means of hydrocyanic acid, potassium cyanide being treated with sulphuric acid. The latter, poured in from outside, through a lead tube, falls within into a basin containing water, at the level of which the cyanide is maintained by means of a special arrangement; the chemical reaction only takes place and the hydrocyanic acid begins to develop after the sulphuric acid has been poured in. Upon completion of the operation, which lasts 3 or 4 hours, the hydrocyanic acid vapours are expelled by an electric fan. Every necessary precaution is taken to obviate the dangers of poisoning by this acid.

Two ferro-concrete vats are used for the disinfection of cotton seeds imported from Egypt and America. The seeds are immersed in a very dilute solution of corrosive sublimate.

DISEASES NOT DUE TO PARASITES AND OF UNKNOWN ORIGIN.

DISEASES NOT DUE TO PARASITES AND OF UNKNOWN ORIGIN

1348 – **The Branching of Rice. Studies and Observations.**

NOVELLI, N. La "ramificazione del riso." Studi e osservazioni). *Il Giornale di Risicoltura*. Anno II, No. 13, pp. 193-201, fig. 1-4. Vercelli, 15 luglio 1912.

The Author applies the term "branching of rice" to the phenomenon by which, under given conditions, from the lowest nodes of the principal culms already well grown (and sometimes likewise from the nodes of the secondary culms), corresponding to the points of insertion of the leaf sheaths, axillary shoots may be put out, which, although later than those

springing from the stock of the plant, continue to grow and finally end by forming panicles.

The varieties of rice on which the Author has up to now mostly encountered this anomaly are Nero di Vialone, Ranghino, Greppi and Chinese Originario; it would seem, therefore, that the phenomen is more common in the varieties attaining greater vegetative growth. Two years ago, at Vigevano, province of Pavia, Italy, in a low-lying rice field sown with Nero di Vialone, the Author reckoned that about 10 % of the plants had branched.

Although the phenomenon may not be very frequent, it nevertheless cannot, owing to its effects, be otherwise than injurious to production. The axillary shoots in point of fact never bring their ears to maturity, and act as real suckers on the principal culms, depriving the latter of their nutriment, inhibiting their development and retarding the ripening of the principal panicles, which are thus left with less vigour and poor in well-formed grains.

Observation and investigation covering several years have led the Author to include among the presumable causes of the phenomenon the irregular function of assimilation on the part of the plant, an enfeeblement of vegetative development due to mechanical causes and excessive height of water in the rice field during sprouting.

To prevent branching of rice the Author recommends: *a*) that no very late manuring, especially nitrogenous, should be carried out (on soils on which conversion is deemed to take place slowly it is necessary to advance the time of manuring; *b*) not to carry out late weeding or rolling; *c*) not to keep the water too high in the rice field during sprouting.

1349 – **The Pathological Importance of the Endocellular Fibres in Vines affected by " Roncet "** (1).

PETRI, L. Significato patologico dei cordoni endocellulari nelle viti affette da "arriciamento." *Rendiconti delle sedute della Reale Accademia dei Lincei, Classe di Sc. fis., matem. e nat*, Vol. XXI, Serie 5a, 2° Sem., Fasc. 1°, pp. 113-119. Roma, 14 luglio 1912.

The disease " roncet " having been attributed to the action of spring cold or also of early autumn cold, the Author proposed to ascertain whether in the shoots or young branches, when deformed or in any way injured by cold, the endocellular fibres always present in vines affected by " roncet " and absent in various other forms of deforming of the shoots in the vine, were to be found. From the investigations carried out in this direction it was found that the formation of these fibres appears to take place, more readily at least, in those vines which have suffered from late colds when the buds were already developed to some extent.

(1) See *B.* June 1912, No. 968. (*Ed.*).

It was consequently necessary to determine whether the formation of the fibres was likewise to be ascribed to the influence of a lowering of temperature. With this object the Author conducted experiments in the spring of 1912, employing vines grown in pots and ungrafted. The reduction of temperature was produced by placing around the plants (the part above ground) a zinc double-walled vessel with ice between the walls. The minimum temperatures ranged from 5 to 2° C. above zero (41 to 35.6° F.), while the maximum outside temperature during some days reached 28 to 32° C. (82 to 90° F.) in the sun. The temperature of 0 or—1° C. (32 or 30° F). was produced by way of exception. Generally the lowerings of temperature were brought about at sunset. Each plant underwent 8 to 15 coolings in the space of 38 days (April 29 to June 5).

The results were as follows:

In those vines already suffering from "roncet" numerous fibres were formed in the xylem in process of growth, as compared with the number of those which formed in previous years: numerous fibres appeared in the epidermal cells of the shoots, while those shoots which had developed before the experiments and were removed, were quite free from them.

In healthy vines which presented no fibres in the xylem of previous years, the latter formed for the first time in those xylem elements which originated under the influence of cold.

In the basal internodes of young branches, fibres also formed in the xylem, but none in the epidermis, or only rudiments in individual cells. The characteristic "court-noué" from cold was not produced. These young branches were just as robust as those of the control vine, which did not exhibit any formation of fibres. These results agree with what is observed in the vines beginning to perish as the result of "roncet."

It follows from the previous enquiries of the Author that the origin of the fibres in the initial cells of the cambium is due to the presence of special excretive substances enclosed in the cytoplasm and having a chemical nature similar to that of the membrane at the time of their formation.

The fact that the formation of these fibres always takes place in the vicinity of the nucleus may lend some colour to the view that it is this latter in which the low temperature causes alteration, either when it is in a state of repose, or more easily during division. The action of cold therefore is the determining cause of disturbances of a normal process: this derangement becomes in turn a determining cause of similar derangements in the cells springing from that originally injured or forming part of the same meristematic tissue. It is beyond doubt that in the plant this state of extreme sensitiveness to this particular action of the cold is determined by special conditions of growth and inherent constitutional properties, inasmuch as otherwise the formation of the fibres should be common to all vines without distinction. The Author dismisses any idea of true patho-

genic causes being here in question, owing to the fact that vines which are starting the formation of fibres frequently show exceptionally vigorous growth.

One of the external factors which, especially in Sicily and Southern Italy generally, favours the recurrence in the vine of this alteration of the cambium, is certainly the mild winter which results in a prolongation of vegetation, both in the native and American vines, until December and in some cases almost throughout the winter. The tissues, in process of slow growth, are in such condition as to be affected by sudden changes of temperature, so that for these vines the dangers caused by the falls in spring temperature are repeated in very late autumn with perhaps still more serious consequences. On the other hand the physiological power of resistance of the tissues to the action of late colds certainly shows a diminution as compared with that presented by plants living in regions with lengthy and comparatively severe winters.

These conditions of vegetation do not alone form the cause of the very extensive diminution in Sicily of vines with irregularities of the cambium: the fact that this process almost acquires the character of a disease of the protoplasm which is fixed in the cambium cells explains the way in which, quite involuntarily, an extensive reproduction and distribution of the so-to-speak diseased wood has taken place. It will readily be understood that a vine originating from a plant with fibrous cells must yield shoots and roots affected by the same alteration. The stunted growth, however, of both these latter presents a close parallelism with this fact. As it has been demonstrated that the fibres form in the plant before the "roncet," it would seem logical to conclude that the alteration of the cambium produces the deformed condition. This question can only be solved by experiments having for their object to determine whether the formation of the fibres and "roncet" represent the effects of one and the same cause. Meanwhile, the present investigations of the Author will contribute a certain number of facts in support of those theories which ascribe the cause of "roncet" to damage by late and early cold.

1350 – Gummosis and the Decay of the Reconstituted Vineyards in Algeria.

TRABUT. La Gommose et le dépérissement des vignes reconstituées. — *Bulletin Agricole de l'Algérie et de la Tunisie*, 18e Année, No. 9, pp. 201-204. Alger, 1er mai 1912.

For fifteen years past gummosis has not infrequently made its appearance in the Algerian vineyards. Some vines offer a prolonged resistance to the disease, or rather live in spite of it and for twenty years or so yield good crops; others on the contrary appear fairly sensitive to the malady. According to the Author the cut surfaces of prunings allow the entry of infection, which descends year by year towards the lower parts of the plant. To recognise the diseased vines it suffices to prune them rather late; in-

stead of the liquid exudation a thick mucilage, hard to dissolve, is seen to appear on the cut surface, having exuded from the vessels of the diseased wood; this does not normally take place when a healthy stock is cut.

By way of remedy the Author recommends that only absolutely sound stocks and scions should be used for grafting.

Can gummosis of the vine be regarded as a disease capable of lowering the vital powers of the infected plant and leading to "roncet," "mal nero", "apoplessia" ("folletage"), "rossore" ("rougeot"), etc., etc.? The experimental evidence is perhaps not yet sufficient, but an observation of the facts justifies the assertion that all the stocks which succumb to the above-named diseases are affected with gummosis. The elimination of young vines attacked by gummosis must, in the judgment of the Author, preserve the other plants from the early decay attributed to "roncet"; it should not be thought, however, that the latter will disappear from the vineyard. The stocks will contract the disease in the course of their existence in consequence of defects in the pruning employed. The decay however will be slow and the disease, which varies according to the vineyards, will only result in the destruction of those stocks which have already given numerous and abundant crops and have already long since repaid all the grower's expenses.

BACTERIAL AND FUNGOID DISEASES.

FUNGI

1351 - **The Fungi of Piedmont, Italy.** (1).

NOELLI, ALBERTO. Micromiceti del Piemonte (2a contribuzione). *Nuovo Giornale botanico italiano*, Nuova serie, Vol. XIX, No. 3, pp. 393-411, fig. 1-3. Firenze, 25 luglio 1912.

In addition to the 179 species indicated in 1905, the Author now enumerates another 157, most of them collected in the mountainous regions of Piedmont, being parasites of cultivated or useful plants. New to Science are *Trichosphaeria pilosa* (Pers.) Fuck. var *Saxifragae*, found on the leaves of *Saxifraga muscoides* at Colle dei Tre Signori (2150 m., 7170 ft.), in the Maritime Alps, and *Leptosphaeria ranunculoides* living on the stems of *Bupleurum ranunculoides* at Colle Sautron (2689 m., 8830 ft.) in Valle Maira.

(1) See also *B.* Nov.-Dec. 1911, No. 3321. (*Ed.*).

1352 – **Fungus Diseases of Cultivated and Wild Plants in the Government of Tula, Russia, during the Summer of 1911.**

TRUSOVA, T. P. Gribniia Bolieani Kulturnekh i Dikorastuscikh Rastenii Tulskoi Gub. po Nabliudeniiam v Tecenie Lieta 1911 Goda. *Jurnal Bolieani Rastenii* (Journal of Plant Diseases) 6-i God., N. 1-2, pp. 1-15. S. Peterburg, 1912.

The hot and wet summer of 1911 was favourable in a high degree to the appearance and spread of fungus diseases in the Government of Tula. The Author made many excursions into the various districts, observing and diagnosing fully 119 different diseases.

Among diseases of field crops, rust attacked almost all the Gramineae without distinction, both grain and forage crops, and it was even possible in this latter case to observe that the animals to which the forage was fed subsequently suffered severely in consequence. *Puccinia coronifera* confined its attacks to oats, causing the leaves to yellow and wither. *Ustilago Avenae*, *U. nuda* and *Urocystis occulta* were found practically everywhere, injuring barley and oats.

Fusarium Tritici covered the blooms of Petelino wheat as with a cobweb, a high degree of infection (45 %) being reached, as ascertained from the average of 4 determinations:

	Total number of ears in a square arshin 5 1/8 sq. ft.	Total number of infected ears
I.	85	53
II	157	75
III	140	54
IV	120	46
Total . . .	502	228

On buckwheat was recorded the appearance of a new disease which leads to the drying and fall of the leaves and is produced by *Ascochyta Fagopyri* var. *tulensis*.

Forage plants suffered from the attacks of *Phyllosticta Medicaginis*, *Uromyces Trifolii* and *Phyllachora Trifolii*.

Uromyces Pisi, *Phytophthora infestans*, etc. respectively attacked peas and potatoes; *Peronospora cubensis* attacked the Cucurbitaceae in various regions in the government. In cherry plantations *Clasterosporium Amygdalearum* has come to be a real scourge, the more so as growers take no control measures of any kind against it. The leaves become covered with a blackish film and dry away; on the fruits dark spots appear, arresting their growth; gum exudes abundantly from the diseased tissues.

Others of the more widely spread cryptogamic diseases were: *Sclerotinia cinerea*, *Puccinia Pringsheimiana*, *Polystigma ochraceum* and *Melampsora Tremulae*.

1353 – Rusts attacking Forest Trees in the West of the United States.

HEDGCOCK, GEORGE GRANT. Notes on Some Western Uredineæ which attack Forest Trees. — *Mycologia*, Vol. IV, No. 3, pp. 141-147. Lancaster, Pa., May 1912.

The following species of Uredineae are enumerated by the writer:

1. *Peridermium filamentosum* Peck: does considerable damage to *Pinus ponderosa* Laws. in parts of Colorado and probably also in the adjoining parts of New Mexico and Arizona.

2. *Peridermium Harknesii* Moore: attacks *Pinus contorta* Loud., *P. Jeffreyi* Oreg. Com., *P. ponderosa*, *P. radiata* Don, and *P. Sabiniana* Dougl.; it extends from Colorado northwards to Montana and westwards to Washington, Oregon and California; it is very abundant on pines in the Rocky Mountains.

3. *Peridermium montanum* Arth. et Kern: attacks the leaves of *Pinus contorta* in the north-western States.

4. *Peridermium coloradense* (Dietel) Arth. et Kern: damages *Picea Engelmanni* Eng., *P. Parryana* (André) Parry and *P. sitchensis* (Bong.) Trautre et Meyer.

5. *Melampsorella elatina* (Alb. et Schw.) Arth.: on *Abies balsamea* (Linn.) Mill., *A. concolor* (Gord.) Parry, *A. grandis* Lindl., *A. lasiocarpa* (Hook.), *A. nobilis* Lindl., and *A. magnifica* Murr.; occurs in the forests of the West and North-West.

6. *Peridermium pseudo-balsameum* (D. et H.) Arth. et Kern: attacks the leaves of *Abies grandis*, *A. lasiocarpa* and *A. nobilis*.

7. *Peridermium conorum-Picea* (Russ) Arth. et Kern: occasionally develops on the cones of *Picea Engelmanni*, causing their abortion.

8. *Caeoma conigeneum* Patouillard: on cones of *Pinus Chihuahuana* Eng., causing abortion; this species is frequent in southern Arizona.

9. *Uredo* (*Melampsora*) *Bigelowii* (Thüm.) Arth.: found on *Salix amygdaloides* Anderss., *S. Bebbiana* Sarg., *S. cordata lutea* (Nutt.) Bebb., *S. cordata Mackenziana* Hook., *S. fluviatilis* Nutt., *S. laevigata* Bebb., *S. lasiandra* Benth., *S. lasiandra caudata* (Nutt.) Sudw., *S. lucida* Muehl., *S. nigra* Marsh., *S. Nuttalii* Sarg. and *S. sessilifolia* Nutt.

10. *Uredo* (*Melampsora*) *Medusae* (Thüm.) Arth.: does most damage, in the West and North-West, to *Populus acuminata* Rydb. and *P. trichocarpa* Torr. et Gr.; also attacks *P. angustifolia* James, *P. balsamifera* L., *P. grandidentata* Michx., and *P. tremuloides* Michx.

1354 – Diseases of Trees in the Eastern United States.

SPAULDING, PERLEY. Notes upon Tree Diseases in the Eastern States. — *Mycologia*, Vol. IV, No. 3, pp. 148-151. Lancaster, Pa., May 1912.

The writer mentions the following fungi as having done considerable damage to trees in the Eastern States in the last few years: *Diaporthe parasitica* Murrill on chestnut in Connecticut, Massachusetts and Maryland;

Lophodermium nervisequum (D. C.) Fr. on *Abies balsamea* (Linn.) Mill. in the Adirondacks; *Peridermium fructigenum* Arthur on cones of *Tsuga canadensis* (Linn.) Carr. in Connecticut; *Myxosporium acerinum* Peck on maples in various districts; *Phoma piciena* Peck on *Picea excelsa* Link in New York State, the Adirondacks and the neighbourhood of Baltimore and Washington.

The writer further notes that in Maryland chestnuts wholly or partly destroyed by lightning look very like those attacked by *Diaporthe parasitica* at a distance.

1355 – **Species of *Fomes* causing Rots of Juniper.**

HEDGCOCK, G. G. and LONG, W. H. Preliminary Notes on Three Rots of Juniper. — *Mycologia*, Vol. IV, No. 3, pp. 109-114, Plates LXIV-LXV. Lancaster, Pa., May 1912.

Descriptions are given of the following species of *Fomes* causing different rots in species of *Juniperus*:

a) *F. juniperinus* (Schrenk) Sacc. et Syd., on living trunks of *J. virginiana* L. Type locality: Tennessee; distribution: Tennessee, Kentucky and Maryland. It produces white heart-rot.

b) *F. Earlei* (Murrill) Sacc. et D. Sacc., on living trunks of *J. monosperma* (Eng.) Sarg., *J. utahensis* (Eng.) Lemm. and *J. sabinoides* (H. B. K.) Sarg. Type locality: El Capitan Mountains, New Mexico, at 2100 m. (7000 ft.); distribution: Texas, New Mexico (where it is very common), Arizona and Colorado. Produces yellow rot.

c) *F. texanus* (Murrill) Hedgc. et Long, on living trunks of *J. sabinoides*, *J. monosperma*, and *J. utahensis*. Type locality: Austin, Texas; distribution: south-west Texas, New Mexico and Arizona, specially common in the two former. Gives rise to the so-called "stringy brown-rot" of junipers.

1356 – **Observations on Apple Mildew.**

MANARESI, ANGELO. Osservazioni sull'oidio del melo. — *Le Stazioni sperimentali agrarie italiane*, Vol. XLV, Fasc. 5-6, pp. 376-380. Modena, 1912.

Apple mildew (*Oidium farinosum* Cooke), as the Author has likewise observed, hibernates in the leaf and flower buds of apple. In spring the shoots attacked by the fungus present a characteristic appearance, with whitish-grey colour: the diseased leaves appear deformed, being thicker, rather shorter and much narrower then the normal leaves. Then, in June and July they dry up. Frequently the flowers attacked by the fungus do not get so far as to open; those which do open wither away without producing fruit; they are small, misshapen and covered in all parts by the hyphae and conidiophores. The peduncle and sepals are less developed; the number of petals is diminished and they become greenish, narrower and rather thicker. The stamens are often much less than the normal in num-

ber with somewhat enlarged filaments and with the anther invaded outside only by the parasite, containing pollen of good germinating quality, although it is not as good as in healthy flowers; the styles are shorter but thicker than usual; finally the ovarian cavities are almost always invaded by the conidiophores of the fungus.

The Author, who has during the last five years kept under observation the behaviour of apple mildew in the province of Bologna, Italy, observes that the parasite only occasions serious damage under certain specified and not very frequent conditions of climate, variety of host plants and soil.

MEANS OF PREVENTION AND CONTROL

1357 – **Permanganate of Potash as a Fungicide for Vines.** (1)

TRUCHOT, CH. Le permanganate de potasse en viticulture. Les poudres permanganatées. — *Le Progrès agricole et viticole*, 33e Année, No. 29, pp. 73-75. Montpellier, 21 juillet 1912.

The Author has repeatedly made trial, and always successfully, against the powdery mildew of the vine, of the following formulae on a basis of permanganate of potash:

A)	Sifted lime or plaster	85 parts
	Powdered permanganate of potash	15 ,,
B)	Precipitated sulphur	85 parts
	Powdered permanganate of potash	15 ,,
C)	Flowers of sulphur	65 parts
	Sifted lime or plaster	20 ,,
	Permanganate of potash	15 ,,

He has also prepared powders on a basis of sulphur, permanganate and sulphate or acetate of copper, which are suitable as a remedy both for powdery mildew and mildew (*Plasmopara*) of the vine.

The Author advises that these powders be applied in early morning while the dew still remains, or after spraying with copper wash or solution on a basis of permanganate or even with water only. Permanganate in powder, embodied in lime, plaster or sulphur, will dissolve owing to the action of the dew or the transpiration of the leaves, and destroy the spores of fungi. In the powders the action of the permanganate appears more sustained than in the solutions; it is slow and prolonged.

The Author recommends the use of the powders at the following times: (1) when the young shoots in process of growth have reached a length of 2 to 4 in.; (2) before and during flowering; (3) fifteen days before the beginning of ripening. And if, notwithstanding, the powdery mildew makes its appearance, the vine should immediately be sprayed with a mixture or a solution on a basis of permanganate; afterwards a powder, also

(1) On the use of permanganate as insecticide, see *B.* Nov. 1910, p.174. (*Ed.*).

on a basis of permanganate, should be employed. According to the Author's formula the mixture is obtained by adding to each 100 gallons of copper wash 1 ¼ lb. of permanganate previously dissolved in two-thirds of a gallon of warm water; the solution is thus composed of water (100 gals) permanganate (1 ¼ lb.) and lime (30 lbs., only added to make it adherent).

With the powder as per formula A, protection is afforded against the powdery mildew for vines very sensitive to sulphur. On the average 22 lbs. of powder or sulphur with the addition of permanganate suffice for one acre of vineyard.

BACTERIAL AND FUNGOID DISEASES OF VARIOUS CROPS.

1358 - ***Urocystis Bornmülleri*, a New Smut parasitic on *Melica Cupani*.**

MAGNUS, P. Eine neue *Urocystis*. — *Berichte der deutschen botanischen Gesellschaft*, Band XXX, Heft 6, pp. 290-293, 4 Textfiguren. Berlin, 1912.

Among the mycological material collected by Hr. J. Bornmüller in Syria and studied by the Author is included a *Urocystis* found on the 18th May 1910 as a parasite on the leaves and inflorescences of *Melica Cupani*, at 1300 metres (4300 ft.) altitude, at the western foothills of the Anti-Lebanon near Heliopolis (Baalbek). The Author gives this member of the Ustilagineae, new to Science, the name of *Urocystis Bornmülleri* P. Magn., and indicates at the same time the systematic characters of the fungus, of which he gives a few illustrative figures.

1359 - **Diseases of Fennel in the Province of Ferrara, Italy.** — See above, No. 1306.

1360 - **An *Exobasidium* on Azaleas.**

BACCARINI, P. Sull'*Exobasidium* delle *Azalea*. — *Bullettino della Società botanica italiana*, No. 6, pp. 127-128. Firenze, 1912.

Recently, in the vicinity of Florence, the leaves of some specimens of *Azalea indica* have suffered seriously from the attack of an *Exobasidium*, the specific determination of which is still uncertain. In Italy, the same disease was already reported in 1907 near Rome; it appeared in 1906 in Holland, and in 1908 it was encountered again in different parts of Germany.

According to these particulars the fungus may have spread from Holland into the other places through the trade in Azaleas, which has its chief centre in that country.

1361 - **Diseases of Roses in Mexico.** — See above No. 1256.

PARASITIC AND OTHER INJURIOUS FLOWERING PLANTS.

PARASITIC AND OTHER INJURIOUS FLOWERING PLANTS

1362 - **Control Measures against Broomrape *(Orobanche crenata)* (1) and Bean Aphis *(Aphis fabae)* (2).**

DEGLI ALBIZI, A. Le orobanche e gli afidi delle fave. — *L'Agricoltura italiana*, Anno VIII (4a serie), Fasc. 13, pp. 391-401. Pisa, 16 luglio 1912.

For several years bean-growing has almost come to a standstill, owing to *Orobanche crenata* and *Aphis fabae*, which hinder its normal growth and destroy almost all the produce.

The Author set himself the task of ascertaining by experiment the best remedy against *Orobanche crenata* and the aphis, not only from the point of view of efficacy but likewise from that of more or less easy application and cheapness.

A. The writer began experiments against broomrape in October 1906 in the province of Florence; he selected three plots, each 180 sq. yards in extent, on land badly damaged every year by broomrape; the soil was a calcareous clay and the plots were on the south slope of a hill and free from trees.

The control methods to be tried were: 1) careful collection of the broomrape before flowering; (2) deep summer ploughing (16 inches); 3) deep sowing (8 to 10 in.) of the beans.

B. Experiments against beans were made in 1909, in the garden of the Royal Technical Institute of Perugia, where beans suffered from aphis every year; an area of 300 sq. yds. was divided into two equal plots and treated as follows: 1) by topping the plants: 2) by spraying with 1.5 % extract of tobacco, with carbolic.

On all the plots the beans were grown in soil ploughed to a depth of 8 to 10 inches, except the second plot in A., in which the depth was 16 inches. The annual manure supply per acre was everywhere as follows: dung, 4 tons; mineral superphosphate, 3 ¼ cwt.; sulphate of potash ¾ cwt. Sowing was carried out in the second fortnight in October in rows 10 inches apart and the seeds were placed 3 to 4 inches deep, except those in the third plot of A., in which the depth was 8 to 10 inches. The same after-cultivation (two weedings and one moulding up) was given during the experiment to the plants of the different plots. The topping was carried out before or just after the appearance of the aphis. Carbolic extract of tobacco was administered twice on the appearance of the aphis, at intervals of four to five days, by means of a common sprayer.

(1) See *B.* May 1912, No 867

(2) See *B.* Aug.-Sept -Oct. 1911, No. 3046. (*Ed.*).

From the experiments carried out it results:

(1) That collecting the broomrape as and when it breaks out of the ground is not only effective as regards destroying the parasite in a few years (5 to 6), but is an economically advantageous remedy, inasmuch as the expense is only rather high during the first years, falling off afterwards notably, so that it becomes negligible at the end of the six years. In point of fact the expense incurred on the first plot at A., was, for each acre, at the rate of 13*s.* in 1906-1907, nearly 6*s.* in 1907-1908, 2*s.* in 1908-1909 and of no account in the three years 1909-1912; the greatest expense, on the plot ploughed 16 inches deep, may be reckoned at 6*s.* 8*d.* per year.

(2) That very deep ploughing of the land had only a slight influence on the arrest of the infection, which proves that the seeds of *Orobanche crenata* even at a considerable depth retain their germinating power and find favourable conditions for growth.

(3) That the sowing of beans 8 to 10 inches deep is no hindrance to the development of broomrape, the latter having during six years of trial (1906-1912) always appeared in abundance.

(4) That the aphids, the appearance of which is immensely promoted by mild winters, and by the cloudy and wet days of the beginning of spring, always appeared in less numbers on the topped than on the other plants, but remained for a long time, taking up their abode by preference on the tender pods and doing great damage; for topping, the annual expense amounted to about 15*s.* per acre.

(5) That carbolic extract of tobacco was found in point of efficacy much superior to topping, so much so that one hour after the application of the remedy all the aphids dropped to the ground dead; carbolic extract not only acts as an insecticide but also as a deterrent to other insect visitors; for each acre, in the two sprayings, about 6lbs. of extract were used per year, six days of work being required; the total expense amounted to 11*s.* per acre.

1363 – **Teazel proclaimed a Weed in Tasmania.**

BLACK, R. A. Proclaimed Weed. Wild Teazel (*Dipsacus sylvestris* Linn.). — *The Agricultural Gazette of Tasmania*, Vol. XX, No. 5, pp. 176-178, 1 fig. Hobart, May 1912.

On March 21st 1912, *Dipsacus sylvestris* was proclaimed a weed by the municipality of St. Leonards, in accordance with § 6 of the Local Government Act, 1906 (6 Ed. VII, No. 31). This plant grows in profusion at St. Leonards, near Launceston, along the banks of the North Esk, at Hobbler's Bridge, Merseylea, Mangalore and probably elsewhere. It is a native of England, Ireland, Central and Southern Europe and Asiatic Russia, and is said to have been introduced into Tasmania as seed in 1873, when wool factories were set up in the north of the island; the writer, however, has received information of its presence in Tasmania as early as 1865.

Fines are to be imposed on those who neglect the destruction of the plant as ordered by the municipality of St. Leonards.

1364 - **A Pernicious Weed: Orange Hawkweed or Devil's Paint-Brush (*Hieracium aurantiacum*).**

Communicated by Mr. T. K. Doherty, chief of the Canadian Bureau of Correspondence with the International Institute of Agriculture.

There is being sent out from Ottawa a conspicuous hanger showing in natural colors the Orange Hawkweed or " Devil's Paint-Brush " which threatens to crowd out all useful plants in certain districts of Quebec unless prompt and vigorous measures are taken to suppress it. The weed cs said to be utterly useless, and spreads rapidly. A short rotation and clean iultivation, where possible, are claimed to keep it under control. In rocky pastures that cannot be tilled, an application of salt is recommended. Merchants, blacksmiths and others, whose places of business attract farmers, and farmers themselves should apply to the Publications Branch of the Department of Agriculture at Ottawa for this hanger which is designated Farmers' Circulai No. 2, Division of Botany. It is published by direction of the Hon. Martin Burrell, Minister of Agriculture.

INSECT PESTS.

GENERALITIES

1365 - **Insect Pests in Canada.**

Communicated by Mr. T. K. Doherty, chief of the Canadian Bureau of Correspondence with the International Institute of Agriculture.

Dr. C. Gordon Hewitt, Dominion Entomologist, reports that cutworms (caterpillars of the *Noctuidæ*) have proved injurious to grain crops in Alberta ; statistical enquiries are being made and reports to date indicate that several thousand acres were destroyed earlier in the season. The chief species appear to be *Euxoa ochrogaster* Gn. and *Porosagrotis delorata* Sm. Eelworms (*Tylenchus*) have been found for the first time injuring fall wheat in Alberta. In Eastern Canada tent caterpillars (*Malacosoma disstria* and *M. americana*) have defoliated very large tracts of forest trees, and orchards have suffered similarly where no attempts were made to control the pests early in the season.

1366 - **Influence of the Great Heats on some Insect Pests of Plants.**

CHAINE, J. Influence des fortes chaleurs sur certains Insectes parasites de végétaux. — *Comptes Rendus hebdomadaires des séances de l'Académie des Sciences*, Tome 154, No. 26 (24 juin 1912), pp. 1833-1836. Paris, 1912.

The Author records in the first place that in the department of Gironde (Blaye, Castillon), similarly to what has been observed by various authors in other parts of France, the great heats of June and July 1911, which began with a prolonged period of drought, destroyed a large number

of grubs and chrysalids of the grape cochylis (*Conchylis ambiguella*) so that the second generation was almost completely annihilated.

The Author has moreover observed that the high temperatures of the summer of 1911 killed a great quantity of grubs of *Monarthropalpus buxi*, a small fly which is a parasite of the box, so that the insect in 1912 appeared in far smaller numbers than in previous years, although the Author has been able to observe specimens of box attacked by it.

1367 – **The Danger of the Introduction of Insect Pests on Imported Nursery Stock** (1).

MARLATT, C. L. Some recent new importations. — *Journal of Economic Entomology*, Vol. 5, No. 1, pp. 73-77. Concord, N. H., February 1912.

This paper forms part of the Proceedings of the 10th Annual Meeting of the American Association of Official Horticultural Inspectors.

The large quantities of nursery stock imported into the United States are not subject to any general inspection : such consignments as have been inspected have frequently contained injurious insects. Nests of brown-tail moth caterpillars continue to be found, 100 being reported from New York State in 1910-11. In the District of Columbia a number of young spruces were found to be badly infested with the spruce aphid (*Lachnus juniperi*), unknown in the United States.

The plants and seeds imported by the United States Department of Agriculture are, of course, carefully inspected, and also kept in quarantine for a considerable period ; in this way twenty different pests have been intercepted, including weevils infesting seeds, grasshoppers with wild grasses, grain insects, the mango-seed weevil, scale insects, Aleyrodid species, a peach-seed weevil (*Anthonomus druparium*), a Cecidomyid and a leaf-hopper.

Some insects that have lately become established are the red-tail (2) (*Dasychira pudibunda*), the small elm-bark beetle (*Scolytus multistriatus*) and the apple-seed chalcis (*Syntomaspis druparum*), all destructive in Europe. *Pulvinaria psidii*, a pest of citrus fruits in south-eastern Asia, and the mango-seed weevil (*Cryptorhynchus mangiferae*) have been introduced into Florida.

(1) See *B.* Jan. 1912, No. 219. (*Ed.*).

(2) Generally known as "hop-dog" in England. (*Ed.*).

MEANS OF PREVENTION AND CONTROL

1368 – **Lady-birds in Piedmont, Italy, useful to Agriculture** (1).

DELLA BEFFA, G. I Coccinellidi piemontesi sussidiari dell'agricoltura. — *Osservatorio consorziale di Fitopatologia in Torino, Foglio d'istruzione* N. 5, 22 pp., 1 fig., Torino, 1912.

After some general references to the benefits which agriculture derives from useful insects, and to the external characters and habits of lady-birds (Coccinellidae), the Author gives a systematic list of the 64 species which occur in Piedmont. Among these the following are of particular interest: *Subcoccinella 24-punctata* L., *Adonia variegata* Goeze, *Semiadalia 11 - notata* Schneid., *Adalia bipunctata* L., *Coccinella 7 - punctata* L., *C. 5 - punctata* L., *C. 10 - punctata* L., *C. 14-pustulata* L., *C. conglobata* L., *Micraspis 16-punctata* L., *Halyzia 16-guttata* L., *Vibidia 12-guttata* Poda, *Thea 22-punctata* L., *Propylaea 14-punctata* L., *Chilocorus renipustulatus* Scriba, *C. bipustulatus* L., *Exochomus 4-pustulatus* L., *Scymnus frontalis* F., *Rhizobius litura* F., *Coccidula scutellata* Hbst.

1369 – ***Glandina guttata*, a Natural Enemy of Gasteropod Pests.**

BOUVIER. La *Glandina guttata*. — *Bulletin des séances de la Société nationale d'Agriculture de France*, Tome LXXII, No. 6, pp. 524-525. Paris, 1912.

The Author has advised the "Société nationale d'Agriculture de France" of the receipt by him from Professor Aibert of Pueblo, Mexico, of 50 live specimens of a large carnivorous gasteropod, *Glandina guttata*. Experiments carried out previously in Mexico have brought to light the fact that this gasteropod is an excellent hunter and that, owing to its size, it is well able to wage an effective warfare against gasteropod pests in kitchen gardens.

With a view to attempting its acclimatisation in France, the Author has distributed the specimens received from Mexico in various localities.

1370 – **Report of the Gironde Commission on Control Measures against the Vine Flea-Beetle in 1911.**

GAYON, U. and LAFFORGUE, G. L'Altise. Rapport sur les travaux de la Commission de la Gironde pour l'année 1911.—*Revue de Viticulture*, 19e Année, Tome XXXVII, No. 966, pp. 841-846, 1 pl. en coul.; and No. 967, pp. 873-879. Paris, 20-27 juin 1912.

Under date of August 24, 1910, a Commission was appointed for the Gironde, France, with instructions to examine into the most effective means of control against vine flea-beetle (*Haltica ampelophaga* Suér.), which for some years past has caused extensive and increasing ravages in the region.

The programme of work will be as follows:

(*a*) To compile a map of the zone invaded by the insect; (*b*) to study the biology of the insect in the department; (*c*) to institute an enquiry into all that has been done hitherto against the flea-beetle; (*d*) to establish

(1) See *B.* Nov.-Dec. 1911, No. 3262 (*Ed.*).

experimental fields with the object of studying the respective value of the already known means of control and such new means as it may seem advisable to try.

The existing experimental fields were situate one at Ludon and the other at Cenon.

The flea-beetle attack appears to be most serious in those vineyards in Gironde which are on damp soil, from which it must have spread to the neighbouring vineyards on drier soil.

From the experiments carried out it appears that controlling measures against the insect during the period of its active life may be really effective provided that an insecticide be resorted to before and during the laying of the eggs. It is easy and at the same time advantageous to combine the use of the insecticide with a cheap method of collecting the full- grown insect. In the zones where the flea-beetle has made severe inroads it is indispensable that these operations should be followed by measures against the larvae. Before doing this, however, if there is no shortage of labour, it will be as well to collect the lowest leaves carrying the eggs and the larvae which have just hatched.

Finally, for these measures to give really effective results, it is essential that those concerned should operate simultaneously on a common plan and over the largest possible area.

The control measures must be organised practically as follows:

(*a*) In the winter: clean the vineyard and its neighbourhood thoroughly before the period when the adult insects look for a refuge for winter; at the same time distribute over the land various refuges to be examined at times of severe cold.

(*b*) In the spring: spray carefully the parts invaded by the adult insects with a basic Bordeaux mixture with 2 % of sulphate of copper, to which add for every 100 gallons 1 ⅓ gallon of solution of nicotine of a strength of 10 % or 3 ⅓ gallons of nicotine of 4 % strength. It will be advisable to combine this operation with the gathering of the insects; for this purpose spray about 15 rows, leaving the next 5 unsprayed; the insects will concentrate in the latter and it will be easy to collect them; against the larvae, if the previous sprayings have been ineffective and if the eggs laid and young larvae appear abundant, it will be expedient to have the lower leaves of the shoots collected; these are the only leaves that carry the eggs, and, if the work is done promptly, the recently emerged larvae will not have had time to get away.

1371 – **Official Spraying Experiments in the United States from the Economical Point of View.**

(Official Experiments in America. Does it Pay to Spray Apple Orchards ?). — *The Producer's Review*, Vol. VII, No. 3, pp. 128-129. Perth, W. A. June 20, 1912.

Results recently reported by the Nebraska Experimental Station,

furnish a valuable illustration of the profitableness of thorough spraying as a regular orchard practice.

In 1906 the experiment station in co-operation with the Department of Agriculture began a series of spraying demonstrations in eastern Nebraska apple orchards. During the five years that these experiments have been continued, demonstrations have been made in 22 orchards, representing 18 localities in 13 counties. The work was done under all sorts of conditions. The trees varied in age from 10 to 28 years and averaged about 18 years. In some orchards they had been well pruned, but in more cases they had been pruned little or not at all for some years. In some cases the spraying was hindered by the closeness of the trees, and in others by a secondary crop of bush fruits. A few orchards had almost every convenience for mixing and applying the spray materials, while others were almost completely without such conveniences.

On the whole it may be said that these spraying demonstrations were conducted not under ideal conditions but under conditions fairly representative of eastern Nebraska orchards, and that, therefore, conclusions rightly drawn from the work should be of value to orchard owners in that part of the State. The results were not exceptionally good. In fact the up-to-date orchardist should be able to get, and does get, better results than those reported here. The following statements give the results obtained from this five years' work.

Number of orchards sprayed	16
Total number of trees sprayed	3300
Average age of trees	18 years
Average number of sprayings per year	4
Average quantity of spray per tree each year	13 gallons
Average quantity of spray per acre (50 trees)	650 "
Average cost of spray material per 100 gallons	87 cents
Average cost of applying spray per 100 gallons	98 "
Average total cost of spraying per 100 gallons	$1.85
Average annual cost of spray material per tree	11,3 cents
Average annual cost of applying spray per tree	12,7 cents
Average total annual cost of spraying per tree	24 cents
Average total annual cost of spraying per acre (50 trees)	$12

Results of Spraying:

Average annual yield and net value per tree:

Sprayed trees:

Marketable fruit, 4.4 bushels at 52 cents	$2.28
Culls and windfalls, 1.1. bushels at 6 cents	0.07
Total, 5.5 bushels at 43 cents	$2.35

Unsprayed trees :

Marketable fruit, 1.8 bushels at 41 cents	$0 73
Culls and windfalls, 1.7 bushels at 5 cents	0.08
Total, 3.5 bushels at 23 cents	$0.81
Difference between sprayed and unsprayed trees	1.54
Average cost of spraying	0.24
Average net gain from spraying per tree	$1.30

Average annual yield and net value per acre (estimated on basis of 50 trees).

Sprayed trees :

Marketable fruit, 220 bushels	$114.40
Culls and windfalls, 55 bushels	3.30
Total 275 bushels	$117.70

Unsprayed trees :

Marketable fruit, 90 bushels	$36 90
Culls and windfalls, 85 bushels	4.25
Total 175 bushels	$41.15
Difference between sprayed and unsprayed trees	$76.55
Average cost of spraying	$12.00
Average net gain from spraying per acre	$64.55

Whether it pays to spray apple orchards in eastern Nebraska is no longer a question.

The records reported here, secured under actual farm conditions, show that spraying pays twice its cost by increasing the yield of fruit, and three times its cost by both increased yields and improved quality. The gain due to spraying one-half acre of apples one year will on the average buy a good barrel pump, 50 feet of hose, 2 extension rods, 2 nozzles and 5 barrels for use in mixing spray materials. The sprayer will last several years and can be used to fair advantage in orchards up to 5 acres.

The gain from the proper spraying of 5 acres will, under average conditions pay for a power outfit including a small gasoline engine, pumps, rods, nozzles, hose, 250-gallon spray tank, elevated spray platform and a truck on which to mount the whole outfit. One such power spray is ordinarily sufficient for an orchard of 20 acres and is often used in orchards of more than twice that size. These results are worthy of serious consideration wherever thorough spraying is not a regular practice.

INSECTS INJURIOUS TO VARIOUS CROPS

1372 – ***Forda formicaria*, damaging Wheat and Oats.**

LOMBARDI, DINA. Alcune osservazioni morfologiche e biologiche intorno alla *Forda formicaria* Heyden. — *Rendiconti delle sedute della Reale Accademia dei Lincei, Classe di Sc. fis., matem. e natur.*, Vol. XXI, 1° Sem., Fasc. 12°, pp. 809-814. Roma, 16 giugno 1912.

In 1910, this aphis was reported near Rome, on wheat and oats. In the following year the Author found it once more as early as the end of October, when the host plants were still quite tender and only possessed the primary root; he observed it at the same time on grasses of the genus *Poa*. The parasite is always attached to the plant at about the level of the ground and is never found on the parts above ground; it is frequently associated with other aphids (*Tetraneura ulmi*, *Pemphigus lactucarius*, *Pentaphis* [*Tychea*] *trivialis*).

Forda formicaria is found in four different forms, which the Author describes minutely: wingless viviparous females, winged females producing the sexual generation, nymphs producing viviparous females, and the sexual generation (male and female). In order to reach maturity under any of these forms it passes through four moults like the other aphids, and consequently four larval stages.

In one case the Author found an infected plant among the roots of which a colony of ants of the genus *Cremastogaster* had established their nest. On pulling up the plant he saw the ants hasten to carry away to a place of safety a number of sexual aphids, male and female, which leads him to believe that perhaps the sexual generation may find shelter in ant hills when the latter are in the vicinity of the infected plants.

When *Forda formicaria* appears in autumn on the gramineous plants there are already found with it among the many roots individuals of *Tetramorium*, *Cremastogaster* and *Myrmica*. During the winter no ants are seen; but towards the end of February, when the first nymph appears, the ants show themselves once more and excavate short galleries among the poots of the infected plants, through which galleries they can reach all rarts of the colony of aphids, to suck the honey. In these galleries the nymphs undergo their metamorphosis; the same galleries are also used by the aphids for their travel and downward movements among the roots during the periods of greater dryness. The ants also contribute to spread the infection, because, when one plant is rooted up, they catch these aphids and convey them to another plant.

On the other hand they never carry the wingless and winged aphids to the ant hills; they may however establish their home among the roots of an already infected plant. In the summer the Author did not find the aphis even on wild grasses, and the infection appears to be interrupted in June and to resume in the following autumn, probably when the resistant egg hatches.

Forda formicaria is very much attacked by the mycelium of a fungus, still undertemined, which kills it in great quantities.

1373 – *Aphis avenæ* and *Crioceris melanopa* injuring Cereals in Roumania.

Purecele Ovazului. — *Câmpul*, Anul-al XI-lea, No. 6, pp. 172-173. Bucuresti, Junie 1912.

In the spring of 1912 *Aphis avenae* (" purecele ovazului ") did serious damage to oats on the property of Baneasa-Herastrau, near Bucharest, and has been observed throughout the territory of the jurisdiction of Ilfov. The above aphis, besides oats, attacks rye, barley and spring wheat. In the wingless form it is 2 to 3 mm. in length, and dark green in colour, with the eyes and the ends of the antennae and antennules black, and the mandibles brown. In the winged form the insect has a reddish head and thorax, green abdomen, and wings with a brown stripe.

The insect lives motionless indide the ear of oats from the middle of May until June, sucks the sap and impedes the development of the caryopsis.

No remedies against this insect are known ; nevertheless it has a natural enemy in the form of an Ichneumon of the family Brachonidæ, viz. *Aphidius avenae*, which devours it.

Another insect, of the order Coleoptera, *Crioceris melanopa* (" criocerul ") the grubs of which suck the leaves of barley and oats until they make them white, has been found throughout the territory of the commune of Baneasa-Herastrau and in the commune of Ilfov. In the perfect state it is red in colour, with black head and whitish elytra. The grubs are oval in shape, yellowish, with 6 legs. The grubs of *Crioceris* were found in the oat fields of Baneasa on the 15th of May and were still among the shrivelled leaves in June. All the leaves attacked assume an ugly appearance. It would seem that no remedy against this insect is known.

1374 – Ants injuring Cereals in Algeria.

Ducellier, L. Les ennemis des céréales en Algérie. Les fourmis moissonneuses. — *La Revue des Colons de l'Afrique du Nord*, 1ère Année, No. 11, pp. 223-227, fig. 1-9. Agha-Alger, 13 juin 1912.

" Harvest ants " are well known in North Africa in consequence of the damage they occasion in certain years to the cereals (wheat and oats), sometimes carrying away almost all the caryopses contained in the inflorescence. The most common species in Algeria is *Aphaenogaster barbara* which is found in the fields from the end of April ; it is endowed with powerful mandibles by means of which it cuts into the inflorescences and can even carry away to a distance of some 20 yards objects exceeding three, four or five times the weight of its body.

In durum wheat the injury seems less considerable than in the case of soft, no doubt owing to the compactness of the ears, the parts of which moreover lie back to back and are exceedingly tough. Oats are preferred by the ants, possibly owing to the greater facility with which they can carry away the spikelets from the panicles.

On an area of four rods there may at times be counted 6 or 7 colonies of ants, the food supplies of which, provided by the grains gathered in the fields, very often exceed one quart for each colony. In this case the loss of the farmer may represent a bulk of a half to one bushel per acre.

In order to check the multiplication of these insects it is advisable to introduce non-volatile poisonous substances into the nest (corrosive sublimate or sulphate of copper) and then carefully shut off the inlet. Also to be recommended is watering with diluted petroleum or petrol or heavy illuminating oil, or the use of carbon disulphide, introduced in the form of capsules into the ant-heap, or of products on a basis of arsenic. Boiling water is also a good remedy, but if the ants' nests are too deep it loses its efficacy by cooling on contact with the soil. An emulsion consisting of oil of petroleum (1 gallon), soft soap (10 lbs.) and water (100 gallons) may also be poured into the nests.

All these substances only yield good results if applied repeatedly so as to get at those ants which in previous treatments may have escaped the action of the insecticide.

Ants love tranquillity; deep ploughing of the soil immediately after the harvest would destroy many. This practice, however, is not easy of execution in Algeria.

1375 – **Some Insect Pests of Maize** (1).

JACK, RUPERT W. in *The Rhodesia Agricultural Journal*, Vol. IX, No. 5, pp. 707-716, plates I-IV. Salisbury, Rhodesia, June 1912.

The writer enumerates and describes the chief insects damaging maize in Southern Rhodesia. They are as follows: maize stalk borer or mealie grub (*Calamistis fusca*); cutworms (larvae of *Agrotis* spp.) (2); surface beetles (*Opatrum aequale* and *Emyon tristis*); snout beetles (*Sciobius* sp. and others); and heteronychus beetle (*Heteronychus arator*).

1376 – **A Springtail damaging Tobacco Seed-Beds: *Isotomurus palustris* (Müll.) Börn., var. *maculatus* Schaeff.**

SPLENDORE, A. Collembolo dannoso ai semenzai di tabacco: *Isotomurus palustris* (Müll.) Börn. var. *maculatus* Schaeff. — *Bollettino tecnico della coltivazione dei tabacchi del R. Istituto sperimentale in Scafati* (*Salerno*), Anno XI, No. 3, pp. 147-151, 1 fig. Scafati, maggio-giugno 1912.

In the spring of 1908 the tobacco beds of the Royal Experimental Institute at Scafati, Italy, were invaded by endless numbers of small dark insects commonly known as "Saltarelli" (springtails) belonging to the order

(1) See also *B.*Dec. 1910, p. 378; May 1911, No. 1582; June 1911, No. 1972; Aug.-Sept.-Oct. 1911, No. 3041; Feb. 1912, No. 441; July 1912, No. 1119.

(2) See *B.* July 1912, No. 2322. (*Ed.*).

Collembola and identified as *Isotomurus palustris* (Müll.) Börn., var. *maculatus* Schaeff.

In the seed beds attacked, innumerable plants recently germinated, and in each case before the putting out of the four small leaves crosswise, were found in the morning with their slender stem pulled down towards the ground, or more frequently cut off, and sometimes with the cotyledon nibbled.

The insect was successfully controlled by means of carbolic tobacco extract in a strength of 0.5 % and by strewing tobacco insecticide powder or ashes. The same remedies were found effective during the spring of the present year, when the appearance of the insect was once more recorded.

As the young tobacco plants grow more robust, *i. e.* as soon as the four cross-leaves have formed, the insect ceases to do harm.

1377 – **Leaf-Anomalies of the Melastomaceae produced by a *Tylenchus*.**

Ross, HERMANN. Adventivblättchen auf Melastomaceenblättern, verursacht durch parasitisch lebende Älchen). — *Berichte der deutschen botanischen Gesellschaft*, Bd. XXX, Heft 6, pp. 346-361, fig. 1-8. Berlin, 1912.

In September 1906, during a botanical excursion in Mexico, the Author observed in the vicinity of the Estate of Tacuapan (Mirador), in the State of Vera Cruz, about 1000 metres (3300 feet) above the sea, a non-flowering plant of the Melastomaceae, *Conostegia subhirsuta* D. C., which presented characteristic deformations. These especially involved the growing points of the last leaves, which were transformed into irregular masses, resembling cauliflowers ; the older leaves, though less essentially altered, exhibited very diverse secondary growths. On the lower face of the leaf, the stalk and the growing axes, these outgrowths were more or less irregularly ramified, sometimes rather flattened, and referable by their anatomical constitution to excrescences. The like behaviour was exhibited in part by the outgrowths of the leaf, some of the latter however assuming a foliar structure and others actually taking the form of typically shaped leaflets. In the younger portions of the excrescences the Author found eelworms very regularly, and among them a *Tylenchus*, which he regards as the cause of the appearance of the above deformities which he has studied from the anatomical point of view.

Similar anomalies were described in 1907, by Rübsaamen, on several Melastomaceae in South America, which the Author has been able to examine. Others again were observed by Hieronymus on a species of *Miconia* from Brazil ; in the latter, which the Author was likewise able to examine, the anomalies are exclusively located on the upper face of the leaf and the principal ribs or near them. The adventitious leaflets here appear more numerous, more robust and thicker than on the material collected by the Author in Mexico ; many of them have a perfectly shaped stalk and blade.

In the origin of formations traceable to galls, particular importance attaches generally to chemical and traumatic stimuli. The experiments carried out by the Author in the hot-houses of the Botanical Garden of Monaco, in order to ascertain whether, in the Melastomaceae, the traumatic stimuli can give rise to the appearance of outgrowths, produced negative results, which however cannot be regarded as final. Notwithstanding this, it seems more feasible to assume the influence of chemical stimuli, as the eelworms possess organs containing active substances, and it is known that the species of *Ascaris*, closely akin to the eelworms and likewise living parasitically, give out poisonous substances in large quantities.

From the Author's investigations it appears proved that the excrescences observed on *Conostegia* are typical galls produced by eelworms, which find food and shelter in them; the same cannot be said in the present case of the adventitious leaflets on the upper face of the leaf, inasmuch as these are not, like the excrescences, in direct relation with the gall agent and do not shelter the parasite, at least in so far as results from the material studied by the Author. It should nevertheless be remembered that in such cases the formation of adventitious leaflets may occur without the direct intervention of the eelworms, because sometimes these leaflets develop freely on leaves in the vicinity of a bed of eelworms. It is perhaps a question of transmission at a distance or the extension of an already existing stimulus of formation. Finally, the appearance of adventitious leaves in the Melastomaceæ may be determined by internal causes (abundant food, temperature, moisture). Such are the cases described respectively by Mozzen and Lemaire on a species of *Miconia* as yet undetermined, and on *Heterocentron macrodon* Triana.

1378 – **A Floral Anomaly in *Bellis perennis* caused by a Gall-Mite.**

MOLLIARD, MARIN. Duplicature florale d'origine parasitaire chez le *Bellis perennis* L. *Bulletin de la Société botanique de France*, Tome LIX (4e Série, Tome XII), 1912, 2-3, pp. 166-167. Paris, 1912.

On three specimens of *Bellis perennis* L. gathered at Matignon (Côtes-du-Nord) in September 1909, on the border of a road far from any garden, the Author has noted the existence of a floral anomaly characterised by: *a*) a proliferation of the original head determining the formation of sessile heads; *b*) floral modifications of the same kind as those observed in the double garden variety; *c*) sterility of the female organs.

In regard to *Bellis perennis* observations have repeatedly been made similar to the foregoing. The Author however desired to give a new description of the anomaly under consideration, as he was able to ascertain that it is due to the parasitic action of a species of *Eriophyes*.

1379 – ***Orchestes fagi*, a Fruit-Tree Pest.**

LÜSTNER, GUSTAV and HERRMANN, B. Der Buchen-Springrüssler (*Orchestes fagi* L.) als gefährlicher Obstbaumschädling. — *Geisenheimer Mitteilungen über Obst-und Gartenbau*, XXVII Jahrg., Nr. 8, S.117-119, Abb. 31-32. Geisenheim, August 1912.

In June 1912 *Orchestes fagi* L. was reported from various parts of Germany as causing great injury to the growing fruit, and occasionally to the leaves, of apple, cherry and pear. This beetle, which habitually only attacks beeches, is found by way of exception as a parasite of fruit trees and on raspberry, cauliflowers and rye. As regards fruit trees, the damage may assume considerable proportions, because the insect pierces the fruit at different points and makes its way deeply into the pulp which it utilises for its food. As a means of control against *O. fagi* it is particularly recommended that the insects should without fail be collected in the early morning and then destroyed.

1380 – **The Paddle-legged Bug (*Leptoglossus membranaceus*).**

GREEN, E. ERNEST. in *The Tropical Agriculturist and Magazine of the Ceylon Agricultural Society*, Vol. XXXVIII, No. 6, pp. 529-530, 1 fig. Colombo, June 15th, 1912.

The paddle-legged bug (*Leptoglossus membranaceus*) has recently been recorded almost simultaneously from various parts of Ceylon as doing a good deal of damage, particularly to oranges; it also attacks tree tomato (*Cyphomandra betacea*), passion fruit (*Passiflora edulis*), peach, plum, Cape-gooseberry (*Physalis peruviana*), beans, peas, marrows, and to a slight extent cabbages.

The bug bites into the fruit and sucks out the juice; fruit so injured falls before it is ripe; in the case of peas and beans, the young pods shrivel and wither.

Besides Ceylon, the insect is recorded from India, the Andaman and Nicobar Islands, Burma, the Malay archipelago, Australia, and Tropical and South Africa.

The only method of control so far found practicable consists in catching and destroying the insects.

1381 – **A Plant-Bug (*Lygus pratensis*) damaging Apples.**

COLLINGE, WALTER E. Remarks upon an apparently new Apple Pest, *Lygus pratensis* Linn. — *The Journal of Economic Biology*, Vol. 7, No. 2, pp. 64-65. London, June 24th, 1912.

In the late summer of 1911 the writer received some apples showing small dimple-like discoloured areas on the surface. This year he found the same appearance on young growing apples. Examination showed that at the discoloured spot a puncture had been made and the egg of an insect deposited; on rearing these eggs the writer found they were those of the Tarnished Plant-bug (*Lygus pratensis* Linn.).

He had previously observed French beans and scarlet runners attacked by an allied species, but apparently there was no record of this species damaging apples in England, though such damage had been described in the United States.

INJURIOUS VERTEBRATES

INJURIOUS VERTEBRATES

1382 - **The Food of the Starling and the Skylark.**

HAMMOND, JOHN. An Investigation concerning the Food of Certain Birds. *The Journal of Agricultural Science*, Vol. IV, Part 4 (June, 1912), pp. 380-409. Cambridge, June 7, 1912.

From February 1911 to January 1912 Mr. Hammond made examinations of the stomach contents of a large number of Starlings and Skylarks, and of small numbers of a few other species, including 12 Rooks. The birds were sent in from Norfolk, Essex and Cambridgeshire and in nearly every case were accompanied by field-notes as to the time of day, weather, kind of ground on which the individual was obtained (as meadow, ploughed field, stubble, turnips, etc.), and whether any damage was being done.

The food is classified under injuries (crops, beneficial insects), benefits (weeds, injurious insects), and neutral; an account is given of the food during each month, and a table shows the proportions of each item of food taken during each month and for the whole year, the method used being to state the actual number per ten stomachs in the case of insects, seeds, etc., and the number of occurrences only in the case of uncountable objects such as leaves and husk.

Starling. — Of this species 239 were examined, the largest number in a month being 29 (in April and in May) and the smallest 11 (in August).

It appears that the Starling is very beneficial during the late spring, summer and early autumn, eating many harmful insects, particularly Heteroptera, leather-jackets, Noctuid larvae, ants, wireworms and click-beetles, and various weevils; of beneficial insects, Staphylinid and Carabid beetles and their larvae figure most largely. During the autumn and to a less extent in spring, much harm is done by the consumption of seed corn, particularly wheat, but many harmful insects are also destroyed at these periods.

Mr. Hammond considers that dressing of the seed-corn with substances making it disagreeable to birds, if satisfactory ones can be found, is the best method of preventing damage; failing this, resort must be had to killing off the autumn immigrants in large numbers, as he says it is they that do most of the harm.

Skylark. — Very few records of the stomach-contents of this species appear to have existed previously: in this investigation 171 were examined,

the largest number in a month being 27 (in March), and the two smallest 6 and 7 (in September and October).

The staple food of the Skylark is shown to be weed-seeds, which are eaten throughout the year: knotgrass (*Polygonum aviculare*) is a special favourite, an average of nearly 16 seeds per bird examined being found; other weed-seeds largely eaten are poppy (*Papaver Rhoeas*), chickweed (*Stellaria media*), black bindweed (*Polygonum Convolvulus*), sheep's sorrel (*Rumex Acetosella*), goosefoot (*Chenopodium album*) and annual meadow-grass (*Poa annua*). The chief damage done is to the leaves of growing crops in winter: in December, January and February about three-quarters of the stomachs examined contained such food; some clover and rye-grass seed is also taken from newly-sown leas, but these two items together form only a small proportion of the food. The insect food is never very abundant, aphids, weevils and Halticid beetles being the chief injurious ones occurring, and a few Carabid beetles among beneficial ones.

ALFREDO RUGGERI, gerente responsabile.

INTERNATIONAL INSTITUTE OF AGRICULTURE

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THE INTERNATIONAL INSTITUTE OF AGRICULTURE

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a) Collect, study, and publish as promptly as possible statistical, technical, or economic information concerning farming, vegetable and animal products, the commerce in agricultural products, and the prices prevailing in the varicus markets.

b) Communicate to parties interested, also as promptly as possible, the above information.

c) Indicate the wages paid for farm work.

d) Make known the new diseases of plants which may appear in any part of the world, showing the territories infected, the progress of the diseases, and, if possible, the remedies which are effective.

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The Canadian abstracting is by Mr. T. K. Doherty, chief of the Canadian Bureau of Correspondence with the International Institute of Agriculture.

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NB. The intelligence contained in the present Bulletin has been taken exclusively from the periodicals, bulletins, and other publications which have reached the Library of the International Institute of Agriculture in Rome during the months of August and September 1912.

The Bureau assumes no responsibility with regard to the opinions and the results of experiments outlined in the Bulletin.

The Editor's notes are marked (*Ed.*).

AGRICULTURAL INTELLIGENCE

GENERAL INFORMATION.

LEGISLATIVE AND ADMINISTRATIVE MEASURES

1383 - **An Extract from the Danish Law of June 8, 1912, Relating to the Measures for Encouraging the Production and Breeding of Domestic Animals.**

(From a French translation made by the "Office de Législation Etrangère et de Droit International" in Paris).

According to this Law, annual State subsidies may be granted:

A) As money prizes at *Shows*, etc., of domestic animals.

B) As grants to *Breeding Syndicates*.

C) As grants for the execution of *different measures* relating to the production and raising of domestic animals.

A. Money Prizes at Shows, etc.

For these prizes only those animals are eligible, which have reliable certificates respecting their parents and the date of their birth, and which are of a good stock and of a breed as pure as possible. Further, an animal which has gained a prize at a Show cannot take another the same year, except at District Shows, or Shows organised on the occasion of a national Congress of the Local Agricultural Associations.

At the *Live Stock Shows of the Local Agricultural Associations* a grant may be made for breeding animals equal to the sum voted by the Association concerned. For those Associations which hold their annual show in common, this amount may be increased by 10 per cent.

Exceptions: 1) No Association which has been in existence for less than one year, or has less than 150 members, or whose minimum contributions amount to only 300 crowns (£16 10s.) may receive a grant; though an exception can, in some cases, be made by the Minister of Agriculture. 2) The grant is not to exceed 4 crowns (4*s*. 5*d*.) per contributing member of the Association.

The grants can be paid as prizes or tenant indemnities: — to stallions of two and three years; to mares of two to four years; to mares of five years and upwards either in foal or with foals; to lots of horses of the same

stock; to bulls of one to three years; to cows and heifers (only cows and heifers from herds of fewer than four milch cows are eligible separately); to lots of cattle of the same stock, or lots of at least three head (but two animals are counted as a lot, if they belong to a herd of less than 9 animals); to pigs, sheep, goats, poultry and bees.

Bulls, after the end of the second year from the coming into effect of this law, are only eligible for prizes, if they possess reliable certificates as to the milk production of their dam (yield and fat content). Cows, after five years from the same period, must show certificates of their own milk production.

Cows and heifers must have been born and bred at the exhibitor's farm, or have been purchased before the age of one year.

The prizes are only given to such animals as their owners declare are to be kept in Denmark for breeding purposes for at least one year after the prize has been awarded, except in the case of rams, which are to be retained until the 1st. of January of the following year.

The prizes are awarded by judges chosen by the Association or Associations interested. The decisions of the judges as to the bestowal of rewards will be incorporated in a report, which will contain a list of all the animals to which prizes have been awarded, together with a short notice respecting their ancestry and qualities. This report, together with the prize-giving accounts, must be forwarded annually to the Minister of Agriculture, who will attend to any irregularities.

The sum allotted to *Live Stock Shows organised by District Agricultural Associations* may be equal, or double, the amount granted by the association interested for distribution in awards at the said shows. The State subsidy is apportioned by the Minister of Agriculture.

These shows may include other groups of horses and cattle besides the classes provided for in the shows of the Local Agricultural Associations, and also, after three years, stallions and bulls of a more advanced age than that fixed by the latter.

The sum granted to *Poultry and Bee Shows* may be equal to the amount voted by the society interested for distribution in prizes. But the show must include the whole country or important districts, and the association applying for a grant must have a contributing membership of at least 1000 in the case of a poultry show, and at least 600 in that of a bee show. For all shows, the requests for grants should be sent to the Minister of Agriculture before the end of March every year.

For *Stallion Shows* and *Bull Shows organized by the State*, sums of 40 000 crowns (£2 200) may be allotted, part of this sum being used for individual prizes and part for progeny prizes.

Individual prizes can be awarded to stallions of 4 to 5 and to bulls of 3 to 5 years.

Progeny prizes may be awarded to stallions over five years which have got in foal at least 40 per cent of the mares served by them in the year preceding the show.

For bulls of over five years of age, progeny prizes may be awarded, when, in a show organized by the State, their progeny has been placed at least in the third class. After the lapse of the third year subsequent to this law coming into force, progeny prizes will only be given to bulls of a milk breed to which prizes have not previously been awarded in a show organised by the State, if they have satisfactory certificates concerning the milk production of their dams.

For these exhibitions of stallions and bulls, the country will be divided into 13 exhibition circles, each of which will be placed under the direction of a *Committee of Stallion Shows* and a *Committee of Bull Shows*. These Committees will be composed respectively of a president, nominated by the Minister of Agriculture, and (as a general rule) of two members elected by the Provincial Agricultural Association concerned for a period of three years; deputies may be appointed. These committees will report to the president of the National Committee of Live Stock Shows, who will forward the reports to the Minister of Agriculture, at the same time making suggestions as to the division of the sums available for prizes.

The presidents of the Show Committees are to fix the dates of the shows and competitions.

The Committees themselves settle the number and value of the awards. Their members act as judges at the shows. Their deliberations, in addition to a report of the results of the shows organized, will be communicated in the form of a report every year before the month of September to the Minister of Agriculture. The reports will contain a minute description of the prize-winning animals, and information as to their lineage and progeny; further, it will contain the accounts of the sums distributed as prizes and used for the organization of the shows.

The presidents of the Show Committees, with the official agricultural advisors who are live stock specialists, form a *National Committee for Live Stock*, which will hold annually an ordinary meeting for the purpose of discussing questions of general interest to its subject. This Committee publishes an annual report. The shows organised by the Local Agricultural Associations are subject to its inspection, which duty is so divided among the different members, that one is present at each show.

B. Grants to Breeders' Syndicates.

Grants can be made to such cattle and horse breeders' syndicates as are recommended by the district agricultural association of their province and whose statutes are approved by the Minister of Agriculture. The grants will be given for selected breeding animals which are the property of the syndicate.

In order to obtain a subsidy of 4/16 (maximum 2 000 crowns, = £110) of the price of the cost of a stallion payable in equal sums in four years, a horse breeders' syndicate must consist of at least 20 members; it must also organize the introduction of mares every three years at least. The stallion must have been a prize-winner (3rd. class progeny prize at lowest), or have been declared admissible to a show organized by the State. It must be a good breeder, and without hereditary unsoundness. Its soundness in these respects must be annually certified by the president of the Committee of the show of the circuit in which the stallion is kept.

The subsidised syndicate is required, for four years, to allow its stallion to serve (on request, and at twice the fee paid by the members of the syndicate) a maximum of 8 mares annually selected by the agricultural advisor of the district and belonging to independent owners.

The grant made by the State to cattle breeders' syndicates, which must number at least 10 members, will be on an average 80 crowns (£4,8*s.*) per bull per annum (varying from 60 to 100 crowns); it will average 100 crowns (£5 10*s.*), varying from 80 to 120 crowns, when half, and 125 crowns (£6 17*s.* 6*d.*), varying from 100 to 150 crowns, when three-quarters of the cows belonging to the members are subject to milk and feed control.

A bull under three years can only receive a grant if it has gained a breeding subsidy, or a money prize (at lowest third class) at a provincial show. A bull of three years and over must have won an individual or progeny prize (though under special conditions exceptions are made).

C. Different Measures Relating to the Production and Raising of Domestic Animals.

Syndicates for Milk Control may receive subsidies of 200 crowns (£11) provided the number of members is not less than 10 and they possess at least 100 cows. These syndicates must be affiliated to the district association concerned and must forward a detailed report to the Provincial Agricultural Association. The latter will publish what seems of general interest in the reports. The total sum of these grants may not exceed 120 000 crowns (£6 600).

Competitions for all the animals of a stable or for families from one stable may be awarded a sum not exceeding half of the expenses incurred by the competition, provided, in all cases, the total of these grants does not exceed 10 000 crowns (£550).

For the establishment of *Centres of Swine Breeding* (nursery herds) and to model and trial pig-breeding establishments a sum not exceeding 25 000 crowns (£1375) may be granted, always on the condition that a like sum is furnished by the associations concerned.

For the *publication of Stud-Books* and *Herd-Books*, a sum not exceeding 15 000 crowns (£825) may be granted.

For the founding of posts for expert agricultural advisors for live stock, sums may be given not exceeding half the salary paid to the holder in his capacity of agricultural advisor, provided that the sum total of these grants does not exceed 30 000 crowns (£1650). For study of the results of the milk-control syndicates and for making abstracts from their reports a sum of 10 000 crowns (£550) is granted.

To *various institutions* having as their object the progress of production and raising of domestic animals, including poultry, and which in the opinion of the Minister of Agriculture are deserving of assistance, the sum of 25 000 crowns(£1375) may be given. Of this sum, a maximum of 5 000 crowns (£275) may be annually devoted to the establishment of stable competitions, provided an equal sum is furnished by the persons concerned.

In conclusion , the State pays the daily expenses and travelling expenses of the presidents of the Show Committees for stallions and bulls, as well as those of the judges of the shows organized by the State, and of the superintendents of the live-stock shows organized by the Local Agricultural Associations ; it also defrays the expenses incurred by the publication of the Report of the National Committee of Live-Stock Shows.

1384 - **The Development of Agriculture and Stock Breeding in the Neighbourhood of Leghorn, Italy.**

DEVELOPMENT OF AGRICULTURE IN DIFFERENT COUNTRIES

Una città di mare che ama le industrie agrarie - *Giornale di Agricultura della Domenica*, Year XXII, No. 35, pp. 274-275. Piacenza, August 28, 1912.

A Live-Stock Show was held at Leghorn on August 17, 1912, organized by the Travelling Lectureship of Agriculture. The fact by itself is not of special importance, seeing that such exhibitions are general throughout Italy at this season of the year, but the show in question presents the following point of interest : it proves that, at Leghorn, which is a maritime town celebrated for its harbour, which its inhabitants have used every effort to enlarge and improve, there have been exerted, for some years, efforts to create an interest in agriculture and stock-breeding. That Leghorn unites these interests with her maritime ones is well brought out by the recent show, which makes prominent the first results of this work. Until a year ago, the city did not possess a cattle-market and to hold one was impossible, owing to the limited extent of the neighbouring territory and the small number of cattle raised. But since the creation of the travelling Lectureship of agriculture, the attempt has been made to carry out an extensive, but simple and rational programme for the purpose of augmenting the local agricultural production, in order to put it in the position of being able to supply the considerable quantities of milk and vegetables necessary for the daily increasing consumption of Leghorn. The farmers of the neighbourhood were advised to replace cereal cultivation

by that of forage crops (lucerne on the plain, sainfoin on the hills) and at the same time to intensify market gardening by using chemical fertilizers, which hitherto had hardly been employed at all.

After this was done, the next question was that of turning the forage to the best account by replacing the local breed of milk cows called " mucca pisana " (Pisan cows), the traditions of which are famous, but which is now worn out and much reduced in numbers, by the brown Schwitz breed having similar characteristics. Every year, stud bulls and cows of the improving breed were thus introduced and hence pure types or crosses with the " mucca pisana " were obtained, which were capable of supplying Leghorn with a large part of the quantity of milk consumed daily (about 2 200 gallons). By this means, the number of cattle in the district was soon increased.

The idea was then conceived of establishing a cattle market in Leghorn ; though to some persons the scheme appeared untimely, or superfluous, it was appreciated at its proper value by the competent authorities, from whom the means necessary for constructing the pens were obtained and the project was duly carried out.

If at the beginning, the market has not been as flourishing as could have been desired, owing to various causes, some of them transitory (the conditions of public health), it is certain that it will gradually increase, especially when the Travelling Lectureship of Agriculture expends the funds necessary for the construction of large and comfortable stables.

The cattle show was held in this very market enclosure. It included both Swiss imported cattle, and the cross-bred animals obtained on the spot from crosses with " mucca pisana." It was a complete success ; the farmers showed great interest in the matter, for they saw in the show the realization of the first item of a programme of paramount importance to local agriculture and the awakening of a new activity destined to afford ever-increasing advantages to the district.

EDUCATION AND EXPERIMENTATION IN AGRICULTURE AND FORESTRY

1385 - **The Selection of Plants in Agricultural Education.**

FRÜWIRTH KARL, Ueber den Unterricht in der landwirtschaftlichen Pflanzenzüchtung. — *Land- und Forstwirtschaftliche Unterrichts-Zeitung*, Year XXVI, Parts 1 & 2 Vienna, 1912.

If that portion of agricultural education which deals with the diseases of plants is to be regarded as a relatively recent subject of instruction, the branch dealing with the selection of cultivated plants must be regarded as even more recent. The writer therefore wished in this article to examine first of all the origins of this instruction ; he then studied its present condition and object, particularly taking into account the class of persons and interests connected therewith in order to give us finally, on the basis of this conception, a comprehensive picture of a reform in the study of

the selection of cultivated plants in agricultural education, a reform based on observation and experience. We shall here deal in general outline with this latter part.

The following sub-division of the education concerning the selection of plants might, in the writer's view, correspond perfectly in a given country to the requirements

Special courses of plant selection in one or more higher Institutes as the case may be (Universities or Colleges of Agriculture) could serve the object of giving students of this science a complete knowledge of the scientific bases on which the selection of plants rests and also of the technical methods to be applied in general selection and in the special selection of cultivated plants.

Such a course of instruction in the selection of plants, which must include special selection, at least with some of the principal plants cultivated, requires at least one hour per week of instruction for one year, with corresponding practical work, since really complete development of this course would require no less than two or three hours per week of theoretical instruction and as many of practical work. In this latter case alone can ample development be given to the theory which must serve as a basis for the selection and the outlines of practical application be gone into, though this latter cannot take the place of the true and proper instruction to be gone through in an Institution having plant selection for its special object.

On the other hand, the instruction required from the majority of Colleges of Agriculture and middle schools (whether they are special or practical) must only deal briefly with the scientific bases of plant selection and their carrying into effect. In the colleges where the above mentioned special course exists, the latter may be made use of in the part dealing with the theory of the selection of plants generally, or, on the other hand, instruction in plant selection may be included in the course or treatise on crops.

In middle, special and practical Schools of Agriculture, this second form is the only one to be considered. In view of the object to be achieved, which is not to prepare the pupil for the professional practice of plant selection but only to make him acquainted with its essential nature and importance for agricultural pratice, in the colleges for this course a series of eight lessons will suffice with three or four practical exercises, and in the middle schools, half this amount.

Finally, special courses should be provided for all those agriculturists who either already carry on practical plant selection or intend to devote themselves thereto, but have no training in general agricultural science sufficient to undertake such work rationally. These special courses for practical agriculturists, wanting for the most part in technical and theoretical knowledge, must make practice above all their aim and may conse-

quently include demonstrations, in connection with seed production, seed selection and diseases of plants.

The need for courses of this character makes itself felt above all where establishments for seed growing or establishments for selection proper exist to produce the seeds required for farming in co-operation with small landowners or farmers. These courses might perhaps profitably be held in these private institutions or in the State-controlled seed station.

For a course of this character a week might be sufficient as regards the practical part.

These courses, the object of which is to give a basis of scientific knowledge to those who already carry on selection in the practical sphere, must be similar to those of the agricultural colleges, with this difference, that both the theoretical instruction and the pracical demonstration could suitably be reduced to a much shorter period of time.

1386 – Agricultural and Housekeeping Instruction at the National School of Agriculture at Grignon, France.

SAGNIER, HENRY. L'Enseignement Agricole et Ménager à l'Ecole Nationale d'Agriculture de Grignon. — *Journal d'Agriculture Pratique*, 76th. Year, No. 34, pp. 242-243. Paris, August 22, 1912.

The Higher School of Instruction in Agriculture and Housekeeping, founded by the decree of the 14th of May last, at the National School of Agriculture at Grignon, is now in full working order. It is open from July 15 to October 15, during the vacation of the National School.

As soon as the opening of the Higher Housekeeping School was known, there were many candidates for admission. It was estimated that, at first, there would be about thirty students, but, in reality, forty-eight made their appearance. Thus it was a complete success.

These students are divided into two sections. The so-called " Higher Section " aims at preparing lecturers and directors of agricultural and housekeeping schools or of girls' dairy schools, and admission to the course is by examination.

The other section, the " Higher Instruction Section," receives the daughters of farmers, who wish to have instruction in agriculture and housekeeping. Three-quarters of the students belong to the first. The only difference between the sections is their origin ; the studies are the same. The students are drawn from nearly all the districts of France ; some have been through the schools of Coëtlogon, or Monastier, others have attended travelling household courses.

They lead an active life at the school. The girls rise at 5.30 a. m. and devote the morning to practical work. They are divided into batches directed by the teachers and are occupied by turns in the kitchen, with household work, in the garden, poultry-yard, dairy, etc.

The afternoon is the time for study : three hours of lectures on domestic economy, hygiene, sewing and cutting out, dairy work, rearing and hygiene of cattle and poultry, gardening and horticulture. Then private study, during which time the students revise their note books. After dinner they meet in the drawing-room. At 9 p.m. they go to bed.

The attention with which the students follow the lessons given to them, proves the confidence which their directors and professors inspire. It may be stated that the new school promises from the first weeks of its existence to fulfil the hopes which it inspired.

Good mistresses of household schools cannot be turned out in three months. For this reason, after this first residence in the Higher School, the students of the normal section are required to take posts as pupil-teachers for nine months as assistants in the household schools, which exist at present ; then they return to the Higher School for another period of three months. At the end of this time, they are entitled to receive the diploma of higher instruction in agriculture and house-keeping, which allows them to teach professionally.

Thanks to the good organization in force at Grignon, it will serve as a nursery for directors of household schools. The farmers' families, on the other hand, find there the necessary elements for making their girls into good farmers' wives.

1387 – **Institutions in the United States giving Instruction in Agriculture.**

U. S Department of Agriculture : Office of Experiment Stations, Circular 97. Washington, 1912.

This Circular includes only those institutions which, through correspondence or other specific information received directly from them, have been listed in the U. S. Office of Experiment Stations among the institutions giving definite instruction in agriculture. This Circular is to be revised at intervals and at the time of revision the names of other colleges and schools offering courses in agriculture will be added.

That the number of such institutions is steadily increasing is shown by the following summary, the figures in parentheses being taken from the list published in May 1910.

Institutions for white students.

Collegiate	61 (57)
Privately endowed colleges	42 (24)
Agricultural high schools receiving State aid	78 (58)
Privately endowed agricultural high schools	8 (2)
Public high schools receiving State aid for agriculture	289 (28)
Normal schools including county training schools and industrial schools for women	196 (156)

Public and private high schools and academies in every State in the Union except Delaware, New-Jersey and Rhode Island	1622 (432)
Correspondence and reading courses in agriculture	26 (18)
Elementary schools (special)	38 (34)
Institutions for negroes.	
Secondary schools	106 (46)
Elementary schools	16 (20)
Institutions for Indians	112
Total number of institutions	2575 (863)
Total increase	1712

AGRICULTURAL INSTITUTIONS

1388 – **" Dansk Land " : Association for the Economic Development of Farming in Denmark.**

Communication to the International Institute of Agriculture.

In July of this year an Association for the Economic Development of Farming was formed in Copenhagen. As the means for achieving this object the following are to serve :

1. Promotion of rational book-keeping in relation to farming.
2. The supply of advice and information to the members on economic questions.
3. Examination and elaboration of official statistics for farming purposes together with supplementary investigations.
4. Improvement of the quality of Danish agricultural produce.
5. Increase of the sale of the produce abroad.
6. Investigations in connection with foreign conditions of production and methods of work.
7. The issue of a journal.

The Association, at the disposal of which considerable means have been placed privately, aims in particular at close collaboration between practical farmers and men of science. It proposes to supply its members with effective forms of book-keeping and grant money prizes, diplomas, etc., for the best account-keeping. The collection and critical treatment of the results of book-keeping are intended to contribute to the elucidation of the vexed questions of recent years as to the remunerative character of Danish agriculture and its several branches.

AGRICULTURAL SHOWS AND CONGRESSES

1389 – **Trials of Milking Machines.**

The Dairy World, Vol. XXI, No. 245, p. 88. London, August 16, 1912.

Trials of milking machines, arranged by the Royal Agricultural Society, will be held in the county of Durham, England, in April or May 1913. The exact place and date have not yet been fixed. It is required that the machines presented at the show should be capable of milking at

least two cows at a time. In the award special account will be taken of the following points : *a*) Time taken in milking. *b*) Weight of milk exclusive of strippings. *c*) Convenience in attachment to the cows, taking into account ease of replacing where the machine has become detached from any cause. *d*) Security of attachment to teats. *e*) Gentleness of operation. *f*) Ease in regulating speed of machine. *g*) Condition of milk. *h*) Ease and thoroughness of cleansing. *i*) Lightness of milk receptacles. *j*) Minimum of supervision during milking, so that man in charge can leave cows, to carry milk away to the dairy, etc. *k*) Price of machine with cheapness of renewal and durability of working parts.

Entries must be sent in on or before February 1, 1913, to the Secretary of the Royal Agricultural Society, 16, Bedford Square, London, W. C.

1390 – **Tenth International Congress of Agriculture at Ghent, Belgium, in 1913.**

Xème Congrès International d'Agriculture à Gand, Belgique, en 1913. — *Journal d'Agriculture Pratique*, Year 76, No. 33, pp. 210-211. Paris, August 15, 1912.

In conformity with the proposition presented to the Ninth International Congress of Agriculture held at Madrid in 1911, the Tenth Congress will be held in Belgium, and will meet in the Universal Exhibition at Ghent.

The International Commission of Agriculture adopted the programme of the Congress at its recent session held in Paris in June, under the presidency of M. J. Méline.

The Organizing Committee is to be presided over by M. Jules Maenhaut, member of the Chamber of Representatives and president of the Belgian Central Agricultural Society. The general secretary is M. Paul de Vuyst, director-general of the Rural Office in Brussels.

The Congress consists of five sections, whose programme has been arranged as follows :

Section I — Rural Economics.

1. Comparison between the importance of agriculture, commerce and industry in the different countries and measures taken by the public authorities in favour of these three branches.
2. Rural depopulation.
3. Organization of small holdings.
4. Agricultural credit.
5. Co-operation between farmers.
6. Mutual agricultural insurance.
7. Organization of the trade in agricultural products.

Section II — Agricultural Sciences. Special Crops. Agricultural Education.

1. Statistics ; scope and importance of establishments for agricultural research. Documentation. Interpretation of results. Best method of registering and of popularising.

2. Agricultural meteorology.

3. Communications on the subject of the chief discoveries made in agriculture in the last five years.

4. What influence have the new methods of selection so far had on the stability of the varieties of cultivated plants ?

5. Hop growing and the hop trade.

6. Vine growing. Establishment of southern vineyards and hothouses by the use of American stocks.

7. What position should the teaching of natural sciences hold in : *a*) higher agricultural education ; *b*) agricultural education ?

8. What principles should be placed first in the good arrangement of primary technical agricultural education ?

Section III. — Animal Economy.

1. Foundations of the classification of breeds of domestic animals.

2. Do the production-values assigned by Kellner to the chief feeds for live stock correspond with the observations of practice ?

3. Zootechnical value of selection. (Sections 2 and 3 may meet to discuss this question).

4. Value of pure lines from the zootechnical point of view.

5. Heredity of coat-colour in domestic animals.

6. What is the zootechnical value of acquired characters ?

Section IV. — Rural Engineering.

1. Application of mechanical energy in agriculture.

2. Breaking-up grass land.

3. Dry-farming.

4. Mechanical and other methods for reducing labour in agriculture. Comparative studies.

5. Farm roads.

6. Joining-up of lands.

Section V. — Forestry.

1. Deforestation : means for preventing it.

2. Sale below value of bark and small wood for burning.

3. Acclimatisation of exotic species.

Each section is directed by a Committee, which will prepare the papers to be presented to the Congress. These papers must be sent in by the

1st. of January 1913 to the Organizing Committee, which will decide as to their publication; they should be as concise as possible and their conclusions should be of such value as to be worth submitting for discussion to an International Assembly.

The International Congress of Agriculture will be held at Ghent from the 8th. to the 13th. of June 1913.

Persons wishing to become members of the Congress must send in their adhesion and pay the fee, which has been fixed at 20 francs.

Public bodies and agricultural societies may join the Congress and send delegates. The membership fee must be paid for each delegate.

Members of the Congress will receive its publications free.

CROPS AND CULTIVATION

1391 – **The Value of Snow Surveys as Related to Irrigation Projects.** AGRICULTURAL METEOROLOGY

THIESSEN, H. H. (Section Director, Weather Bureau). — *Yearbook of the United States Department of Agriculture*, 1911, pp. 391-396 + plates XXXVII-XLII + fig. 12. Washington, 1912

If the precipitation in the mountains were known, some knowledge of the amount of moisture available for irrigation and other purposes would then be at our disposal. But owing to the almost total absence of inhabitants in the higher levels, there are no facts upon which the probable water supply may be based. Granting that the falling snow may be measured, then one can know the winter's precipitation, but not the available water supply, because during the winter thaws may occur, causing melting, the amount of which cannot be easily estimated. The problem, then, is to find the water equivalent of every patch of snow in a watershed. To do this requires the measuring of the area of every patch above the highest canal or above the dam, and finding the average depth and density.

The United States Weather Bureau undertook to work out this problem in the spring of 1910. A watershed of about 6880 acres was selected, which was free from cliffs and having fewer natural obstacles than any other canyon within easy distance of Salt Lake City, Utah. The instruments used consisted of a density tube and scale, an aneroid barometer, a compass, and a metal semicircle with plumb and pointer to secure slope angles. After a general map had been sketehed, showing the main canyon and the outlets of all the branches, the work consisted in going up the bottom of each gulch and back and forth along the slopes, measuring the snow depth and density every thousand feet or so, plotting the gulch on the preliminary sketch more carefully, and mapping the snow areas. The average of the 277 depth measurements was 36 inches, and the average water

equivalent was 11.5 inches, or 32 per cent., making, for the 4000 acres under snow in the last ten days of March, 1911, 3833 acre-feet of water, or enough to spread 14 inches deep over all the land irrigated under the stream.

The most apparent value of a snow survey to the irrigating farmer is, that with the knowledge acquired he can select his crop more intelligently. The survey should of course be made just before planting time. In general, three cases of water supply may be considered: first, when an average amount may be assured; second, an abundant supply; and third, an amount smaller than the average. If the survey shows that an average amount of water will be the farmer's portion, then he should plant his usual crop. If more than the average amount can be guaranteed, then several plans may be carried out: a crop requiring the usual amount of water may be planted, and surplus water sold to adjacent dry farms; or a crop requiring a great deal of water may be planted, or one that matures late in the season. If less water than usual has been measured, then the farmer must plant a crop requiring but little water; or he may let some of his land lie fallow, or plant a crop that matures early. A knowledge of the amount of water available may also have several applications while the crop is maturing; thus, to regularize haycutting.

Further, if a gaging station were established above the highest canal, then, if the two variable factors, seepage and evaporation, could be approximately estimated, the irrigators would know at any time during the season just how much moisture still remained in the watershed. It would serve to indicate how fast the snow in the upper parts of the watershed was melting, and this should be valuable information both to the irrigating farmer and the owners of a dam used for conserving the water for either power or irrigating purposes.

Finally, a survey of this character is stated to be worth much more than the certainty it gives the irrigator regarding the future of his crop or the knowledge as to what crop he should plant. It eliminates his products from that class those amount of production is more or less problematical. It tends to steady prices, and, in addition to the taking away of these uncertain features, gives a crop, although not matured, a money value which it would not have, to such a great measure at least, if the water supply were not known.

AGRICULTURAL GEOLOGY

1392 – **The Different Types of Soil in Russia in Europe.**

TUMIN, G. Obsor Obstchago Kharaktera Potchv i eià Ismienenii po sonan. — *Jurnal Opêtnoi Agronomii* (Journal of Experimental Agriculture), Year XIII, Part 3, pp. 321-348. S. Peterburg, 1912.

The three principle types of soil in Russia in Europe are so arranged as to form three wide bands extending from the northwest to the southeast. In the north-west threre are the "podsols", in the centre the

" chernozioms " (black soils), and in the south-east the alkaline, or semi-desert soils.

I. In the stratification of the podsol there are to be distinguished, a higher horizon A, which is very different from the lower horizon B., and characterized by patches and bands of a whitish colour, which are of a humic origin. Three sub-types are to be distinguished :

a) podsol proper, which occupies the central portion, and in which the horizon A divides into two sub-horizons : A_1 of a greyish and A_2 of a whitish colour. In passing from the central zone in a south-east direction, the characteristics of the podsol become less marked ; at first, *b*), occur typical podsols in which the horizon A_2 is much reduced ; finally, a group *c*) of ill-defined podsol occurs, where the whole of the horizon A is uniform and grey (A_3).

The factors which cause the podsols to lose their characteristics as they approach the limits of the zone are, however, very different in the two directions. In the north-west, the change is due to a high degree of humidity and to a low temperature, but in the south-east on the contrary, to a low degree of humidity and to an elevated temperature. This brings about remarkable differences in the weathering processes and in the concretions, etc., contained in the resulting soils. Further in the soils of the north-west portion, there occurs a whitish sub-horizon B_2 which occupies the lower part of B_1 and has a depth of 70 - 100 c m. (27 to 39 in.).

The above deals with cases (which form a vast majority) where the sub-soil is clay and the configuration of the ground a plain. In passing from clays to sands, the characteristics of the podsol become less marked. Even in the centre of the zone, where over clay subsoil there is podsol, over loam subsoil the soils are of the podsol type, and over sand subsoil ill-defined podsol. As to the effect of the configuration, it is to be observed that in passing from the plain to depressions, the characteristic podsol facies becomes less marked in the clays and is accentuated in the sands ; sometimes another sub-horizon, A_1, makes its appearance between the two sub-horizons A_1 and A_2.

The formation of peat and the rapid processes of oxidation lead to the gradual disappearance of horizon B and consequently of the typical podsol of the North. In the South, the progressive increase of calcium carbonate in the subjacent rocks leads to the formation of intermediate types, which mark the passage into the " black soils ".

The structure of the podsol varies with the locality and the nature of the subsoil. In the south-east, on the clays, horizon A has a granular structure and B an oolitic-pisolitic one. In the central zone, in A and B a kind of stratification is to be seen ; this disappears on passing towards the north-west. With a sandy subsoil, there is no trace either of granulation or of stratification.

II. Turning to the chernoziom or "black soils", as regards the strata the occurrence may be noticed of: an upper horizon, A, of a dark grey colour and a lower one, B, much lighter in hue and free from whitish spots or bands. The sub-types vary according to the presence or absence of incrustations or infiltrations of silica: *a*) silica in the two horizons A and B, a sub-type predominating in the north-west; *b*) silica in horizon B, only in the central part of the chernoziom zone; *c*) no silica at all, in the south-east district. In the central portion, and with a clay subsoil, A and part of B present a granular structure, which becomes coarser on passing in a northerly or southerly direction. Where the subsoil is sandy, the structure is everywhere coarse. The humus content is 12% in the second sub-type, 4 to 6% in the first and 3 to 5% in the third.

III. In the alkaline soils, horizon A is clearly distinguished from horizon B, which is, as a rule, much better developed, compact and free from white patches or bands. Three sub-types occur: *a*) alkaline soils proper, where the horizons A and B are clearly marked off from one another by their colour and structure; between A and B there is a thin layer of whitish substance, of which the contact surface is smooth as if it had been polished; *b*) soils with alkalis, where the surfaces in contact with A and B are very irregular and the thin intermediate layer is absent; *c*) slightly alkaline soils, in which the division between A and B is no longer very distinct, although B is characterized by being more compact.

According as the sub-horizon B_1 presents a columnar, prismatic, or ganular structure, the alkaline soils are columnar, prismatic, etc. The structure of horizon A is very variable, schistose (lamellar), granular, globular. The colour may be uniform, or the reverse; in the latter case, two horizons appear: A_1 grey and A_2 whitish.

All that has been said concerning the structure of the alkaline soils applies equally to soils with alkalis and to slightly alkaline soils.

In the central part of the zone, the alkaline soils proper and the soils with alkalis are equally represented, the colour of the soil is a brownish grey and its humus content is 3%. Towards the morth-west the alkalinity decreases, while the humus content increases (5%), giving the soil a chestnut colour. In the south-east soils containing less alkali are also found, but they are of a lighter colour, nearly white, owing to the presence of much calcium carbonate.

1393 – **The Soils of Transbaikalia.**

FILATOV, M. Potivi Basseinov Bielago Uriuma i Kuenghi Sabaikalskoi Oblasti. — *Jurnal Opătnoi Agronomii* (Review of Experimental Agriculture), Year 13, Part III, pp. 225-229. S. Peterburg, 1912.

The work is subdivided into the following parts:

1. Relief and hydrography; data as to flora.

2. Geological conditions.
3. Climatological conditions.
4. General scheme of the distribution of the various types of soil.
5. Soils, their structure and composition.
6. Analytical data.

The region under examination extends between the courses of the Biela Urium and the Kuyenga, tributaries on the left bank of the river Shilka which runs through Transbaikalia. It is mainly mountainous, furrowed by deep and narrow valleys ; the flora is that of the taiga. The predominating species is larch, *Larix dahurica* Turez., which grows in the highest localities, on steep slopes and on valley-sides. Then there is *Betula fruticosa* Pall., which, in clumps and belts, alternates with grass land where the soil is less broken and uneven. Only on some sunlit slopes with southern exposure does the steppe flora appear.

The climate is purely continental and characterised by the great annual and daily ranges of temperature. The coldest month is January, with a mean of -30° C. and a minimum of -56° C. ; the hottest, July, with a mean of 20° C. and a maximum of 38° C. At night the temperature falls below zero even during summer, and the month of July alone is quite free from frosts. The rainfall amounts to 300 mm. (nearly 12 in.) per year, of which 217 mm. (8.5 in.) falls in the months of July and August.

The geological nucleus is provided by ancient crystalline plutonic and volcanic rocks, granites, gneiss, syenites, porphyries, rhyolities and basalts, which together with the clays and sand hills, form the whole of the formations from which the soils have been formed. From the agrogeological point of view almost all the land belongs to the type of " podsol "; but it is a matter of great difficulty to find there genuine and true " podsol " in its characteristic structure and composition. " Podsols " with modified characteristics predominate, especially in the higher localities, with horizon *A* uniformly grey and horizon *B* having whitish streaks and spots, formed by humic substances. In the low fluvial terraces the " podsol " is associated with semi-marshy types. The absence of a typical " podsol " is explained : 1) by the many phenomena of washing away which periodically interrupt and modify the process of formation ; (2) by the climatic conditions, which favour phenomena of mechanical weathering but hinder those of chemical weathering. The thickness of these soils is about 20 inches.

Another type of soil largely represented is the semi-marshy type, of which the author distinguishes three sub-types :

1). The semi-marshy soils in the lower parts of the valley-sides and gentle hill slopes. Their degree of moisture is always extremely high. They are generally covered with dense thickets of *Betula*.

2). The semi-marshy soils, which in the terraces, both fluvial and structural, alternate with the "podsols."

3). The semi-marshy soils of the terraces formed on the southern slopes of the valleys. Here the flora is that of the steppe, with scattered groups of *Betula fruticosa.*

This soil has a thickness of just over 4 feet, at which depth the land is generally frozen. With regard to the structure and composition may be mentioned: 1) at horizon *B*, stratified concretions with extremely hard black nuclei; 2) beneath horizon *B*, a stratum of humus which stands out clearly owing to its reddish colour. The writer explains the presence of this by the formation of an exceedingly large number of cracks which greatly increases the capillarity of the soil and makes the circulation of water easier. In contact with the frozen stratum the earthy particles are deposited and the humus bodies suspended in the water in the colloidal state tend to descend towards the subsoil at the time of thaw of the more superficial strata.

In the lowest parts of the valley and on the river banks are found marshy soils formed of silt, with the floral elements of the grass land, and with *Carex, Calamagrostis* and *Eriophorum* where the degree of moisture is greater.

SOIL PHYSICS, CHEMISTRY AND MICROBIOLOGY

1394 – **Investigations into the Nature of Pasture Soils.**

GIMINGHAM, C. T.: Variations in Pastures. — *Science Progress in the Twentieth Century*, Vol. VII, No. 25, pp. 133-146. London, July 1912.

ID.: English Work on Pasture Soils. — *Internationale Mitteilungen für Bodenkunde*, Vol. II, Parts 2-3, pp.245-257. Berlin, 1912.

The writer, in dealing especially with the conditions which obtain in England, draws attention to the fact that the important contributions to our general knowledge of the factors governing soil fertility have almost exclusively resulted from the study of arable soils; the problem awaiting solution is how far the conclusions obtained by the study of arable soils are directly applicable to pasture soils. In the case of the latter, the most important fact is, that the soil is occupied by a crop continuously, and the most obvious results of this continuous occupation are concerned with the physical condition of the soil. From this fact the following questions arise:

a) Does mechanical analysis, which has given such valuable results in the study of arable soils, afford equally useful indications with pasture soils?

b) Is chemical analysis a useful guide, and if so, can the large amount of data obtained from arable soils be taken as standards?

In order to answer these questions, the writer has examined the recent work done in England on the subject: that carried out by the Cambridge

School of Agriculture and the Rothamsted Experiment Station (1) as well as the data he has himself collected.

The conclusion reached in the first mentioned investigations is that the mechanical composition of the soil is probably the chief factor in the improvement of poor pasturage. A fairly good mechanical condition is essential; soils with a very high proportion of either the coarsest or finest grades of particles are never likely to make really useful grazing land, whatever the manurial treatment. These investigations make it apparent that the amount or "available" phosphates is another characteristic factor for the production of good pasture land.

The results of the two other series of investigations mentioned, show that the question has not yet been fully answered, since it is evident that differences in the textures of the respective types of soils existed, which were not indicated by the results of the analyses, and we are forced to draw the conclusion that mechanical analysis, according to our present methods, is not of the same value in the study of pasture soils as it has proved to be in the case of arable soils. This is probably due to the controlling influence exercised by the organic matter in pasture soils, to which a place of primary importance must be given in determining the type and composition of the herbage. Physical properties, which might be inferred from the result of mechanical analysis, are, in the case of soils permanently occupied by grass, often masked by the influence of the organic matter present; the undisturbed condition of the surface soil and the consequent slow rate of decay of the humus accounts for this.

As to the manner in which the action of organic matter becomes operative, we are at present entirely in the dark. Analyses of the herbage by our present methods have led to nothing, and it seems probable that before it will be possible to throw much light on this point, we shall need to possess more delicate methods of food analysis and to know much more of the nature and properties of the organic matter as it exists in pasture soils.

1395 – The Influence of Forest Vegetation on the Weathering of Minerals in the Sandy Soil of Dunes.

VOGEL VON FALKENSTEIN, K. and SCHNEIDERHÖHN, H. Verwitterung der Mineralien eines märkischen Dünensandes unter dem Einfluss der Waldvegetation. — *Internationale Mitteilungen für Bodenkunde*, Vol. II, Parts 2-3, pp. 204-213. Berlin, 1912.

As a sequel to his studies on the suitability of dunes for afforestation (2), the writer draws attention to the fact, that more than half of the forests of Prussia grow upon quaternary sandy soil, and he considers in this article

(1) See No. 1141, *B.* Aug. 1912. (*Ed.*).

(2) See No. 1014, *B.* July 1912. (*Ed.*).

the mineralogical composition of these soils and their decomposition due to the forest vegetation.

The lime and potash in these soils are entirely furnished by the abundant felspars present ; the resulting clay considerably modifies the physical nature of the soil ; it should be noticed, that under similar conditions, microclin is much less attacked than orthoclase. The hornblendes and their chloritic decomposition products must be regarded as the source of the magnesia and iron ; but some is derived from metallic iron minerals. Apatite, though rare, is important as the source of phosphoric acid.

The method adopted in these researches is purely petrographical, and consists in treating the fresh and the decomposed material in such a manner as to separate the mineral elements according to their specific weight, and in counting them under the microscope. Thus, a qualitative and quantitative estimate of the composition of the soil can be obtained and an idea of the nature of the decomposition due to the effect of vegetation. The writer recommends for the study of soils, the employment of this petrological method in conjunction with the usual methods of entire and partial chemical analysis.

1396 – Some Factors influencing Soil Nitrification, and their Practical Bearing.

(1) PATERSON, J. W. and SCOTT, P. R. The Influence of Soil Moisture upon Nitrification. — *The Journal of the Department of Agriculture of Victoria*, Vol. X., Part 5, pp. 275-282 + figs. 2. Melbourne, 10th. May, 1912.

(2) ID. — Influence of Certain Soil Constituents upon Nitrification. — *Ibid.*, Part. 7, pp. 393-400 + figs. 2. Melbourne, 10th. July, 1912.

Two series of experiments are reported by the writers, respectively Experimentalist and Chemist for Agriculture to the Department of Agriculture of Victoria.

How the moisture conditions of the soil affect the nitrification. — The method of investigation was as follows : Air-dry soil equal to 300 gr. dry soil was placed in a bottle of 500 c. c. capacity. There were two sets of experiments in consecutive periods, using about 100 bottles each. In the first experiments water was added to bring the original soil moisture up to 10, 20, 30, 40, 50, 60, and 70 per cent. of its total water-holding power. In the second the steps were 10, 20, 30, 50, 70, and 90. Before charging the bottles, the weighed soil was thoroughly mixed with its proper quantity of water ; one-half of the bottles got water only, the other half got 5 c. c. standard ammonium sulphate solution in their water. The bottles in the cupboard were corked and twice weekly aspirated for 5 seconds. In each experiment the ammonia bottles and the control blanks were done in duplicate, and the average results taken when the figures were close. After the incubation period determinations were made of moisture, and of the nitrate nitrogen by a colorimetric method.

The results of the first set of experiments give the progress of nitrification in a sandy soil with the different degrees of moisture, the ammonia nitrogen added being 70.7 parts per million, the length of incubation period 27 days, and the mean temperature 66° F. With the water-holding capacity between 40 and 70 per cent., the rate of nitrification did not vary in any important degree. At the various steps below 40, there was a notable falling away; 10 per cent. practically stopped nitrification, and at 20 the rate was only one-seventh of the best case.

In the second set of experimnts two classes of soil were used, the one the same sandy soil as above, the other a medium clay. Ammonia added = 333.33 parts per million; length of incubation period, 42 days; mean temperature, 68.5° F.

Results.

Water in soils		Nitrate nitrogen per 1 000 000 parts dry soil			Per cent. of ammonia nitrified
Per cent. of saturation	Per cent. of dry soil	Control blanks	Ammonia bottles	Excess with ammonia	
			Sandy soil.		
10	2.67	8.33	10.03	1.70	0.51
20	5.35	16.30	60.12	43.82	13.15
30	8.03	19.25	82.79	63.54	19.06
50	13.38	21.71	110.35	88.64	26.59
70	18.73	19.18	117.65	98.47	29.55
90	24.08	9.11 (?)	27.68	18.57 (?)	5.57 (?)
			Clay soil.		
—	2.67	9.0	10.55	1.55	0.46
—	5.35	13.65	14.52	0.87	0.26
—	8.03	24.23	198.80	174.57	52.37
—	13.38	34.65	277.80	243.15	72.96
—	18.73	38.50	340.50	302.00	90.61
—	24.08	1.78 (?)	262.60 (?)	260.82 (?)	78.26 (?)

The results for the sandy soil confirm that there is a long range in the medium degrees of moistness which are about equally favorable for nitrification. As would appear, the best degree of saturation for this soil runs from 40 to 70 per cent; beyond those limits, increasing wetness acts more sharply than increasing dryness. In the 90 per cent. saturation, however, the result was poor owing probably to the water excluding air from the pores of the soil. Referring to their mechanical analyses and the water content

Scheme of Experiments.

Test. N°	Constituent added to soil	Per cent. present in soil	Chemical equivalents	Character of materials
1	Nothing	—	—	—
2	Carb. of lime	2.00	—	commercial whitening, 90 p. c.
3	» »	0.50	—	»
4	» » of magn.	1.68	= test. 2	carb. and hydrate, magnesia 40.62 %
5	» »	0.42	= » 3	»
6	Gypsum	3.44	= » 2	chemically pure
7	»	0.86	= » 3	»
8	Lime	1.12	= » 2	freshly ignited, 99 per c.
9	»	0.28	= » 3	»
10	Ferric hydr.	1.43	= » 2	precipitated, washed and dried
11	Common salt	0.125	—	chemically pure
12	» »	0.25	= 2 × test. 11	»
13	Citric acid	0.104	= carb. in soil	commercial crystals
14	» »	0.213	= *id* + 0,10 p. c.	»
15	Starch	1.14	—	prepared, water 12,1 p. c.
16	Sugar	1.00	= org. matt. in 15	castor sugar, 99,5 p. c.
17	»	1.00	(sealed)	»
18	Superphosphate	0.0025	= 100 lbs. phosph. acid per acre foot	phosph. ac., 20 per cent.

of the two varieties of soil, it was apparent that clay holds its water more than the sand ; and the effect of this is seen upon the nitrifying action, because while with sand it was the driest bottles only which remained stationary, with clay the second driest also failed to act. With sufficient moisture, nitrification proceeded rapidly in the clay, and the water optimum was apparently higher with clay than sand. The nitrification was altogether more active in the clay than the sandy soil.

How lime and other substances in the soil affect the nitrification. — In these investigations the method of experiment was essentially the same as

Results.

Test No.	Constituent added	Nitrate nitrogen per 1 000 000 parts dry soil						Per cent of ammonia nitrified	
		Control blanks		Ammonia bottles		Excess with ammonia		I	II
		I	II	I	II	I	II		
1	Nothing	22,01	33,03	94,33	108,99	72,32	75,96	21,69	22,79
2	Carb. of lime . . .	38,02	54,00*	347,37	412,83*	309,35	358,83	92,86	100,00
3	» » » . . .	33,26	39,92*	299,38	329,97*	266,12	290,05	79,83	87,01
4	» » magn. .	22,01	38,02	55,12	329,97	33,11	291,95	9,93	87,60
5	» » » .	26,40	66,53	52,75	299,97	26,35	233,44	7,90	70,03
6	Gypsum	16,51	33,02	94,33	139,59	77,82	106,57	23,34	31,97
7	»	13,20	29,35	82,45	131,97	69,25	102,62	20,77	30,78
8	Lime	3,27	3,92	4,04	4,37	—	—	—	—
9	»	14,61	38,02	4,39	13,09	—	—	—	—
10	Ferric hydr. . . .	14,61	26,37	94,33	188,89	79,72	162,52	23,91	48,75
11	Common salt. . . .	16,50	26,37	26,37	68,90	9,87	42,53	2,96	12,75
12	» » . . .	13,20	26,37	4,40	29,94	—	3,57	—	1,07
13	Citric acid	6,53	10,93	73,20	70,09	66,67	59,16	20,00	17,74
14	» »	3,92	nil	33,02	59,99	29,10	59,99	8,73	17,99
15	Starch	nil	10,93	nil	55,84	—	44,91	—	13,47
16	Sugar.	»	2,85	»	92,66	—	89,81	—	26,94
17	»	»	nil	»	nil	—	nil	—	nil
18	Superphosph. . . .	19,01	29,35	94,33	136,62	75,32	107,27	22,59	32,18

* Refilled after 21 days.
I = Period of incubation, 21 days; average temperature, 72.16 F.
II = Period of incubation, 51 days; average temperature, 69.98 F.

in the moisture investigations. Air-dry soil, equal to 300 gr. of dry soil, including the added substances, if any, was wetted up to 60 per cent. of its water-holding capacity, and 5 c. c. ammonium sulphate solution was mixed with the wetted soil, so that the nitrogen equalled 333.33 parts per million of any soil. The soil was a sandy soil deficient in lime.

Carbonate of lime had the best effect on nitrification of all substances tried, and its action was also the soonest felt. Caustic lime had a bad

effect in the fresh state, and practically stopped all nitrification ; the larger application did most harm. Gypsum had a moderate effect in encouraging nitrification, but was not at all equal to carbonate of lime; the heavier application was a trifle better than the smaller. Magnesia as carbonate seems to exercise a fine effect somewhat resembling mild lime. Superphosphate has appreciably increased the nitrification, the soil being very poor in phosphoric acid (0.032 per cent.). Ferric hydrate has been distinctly favorable to nitrification, although slow. Common salt and citric acid had altogether bad effects. Starch and sugar at first provoked denitrification, the sugar re-starting nitrification soonest. The sugar bottle kept sealed never showed nitrates.

*

Suggestions for Farming Practice.

I. *As to moisture :*

a) nitrification is inactive in soils employed while they still contain about three times more moisture than in their average air-dry condition ;

b) at the lower limits of moisture less water is required to start nitrification in sand than in the clay ;

c) at the higher limits of moisture nitrification is stopped by a smaller quantity of water in sand than in clay ;

d) while the optimum amount of water probably varies for each soil, and is higher for clay ; still for both soils it lies within the range of 14 to 18 parts per 100 of dry soil ;

e) a rise above the optimum amount of water is more harmful than an equal fall below it ;

f) if the summer working of follow land helps to retain water in the surface soil, this water may have a powerful influence upon the production of nitrates for the next crop ;

g) a growing crop may reduce the nitrate supply for the next crop in two ways : it may use up all the nitrates actually present, and it may so dry the land that nitrification in the interval between crops is reduced to a minimum ;

h) the moisture requirements for nitrification suggest that in dry seasons a single flooding of fallow land might be followed by good results.

II. *As to soil constituents :*

a) mild lime is an effective means of promoting nitrification, and its action begins at once ; it is a safe dressing both as regards quantity and time of application ;

b) caustic lime requires greater caution in its use ; it should not be applied too near the time of seeding, nor during the growth of any crop ; it should be used in smaller quantities than mild lime ; it will probably have a similar action to mild lime eventually ;

*

c) magnesium carbonate in a limestone may or may not damage crops, but it appears to favour nitrification ;

d) red and brown soils, other things being equal, favour nitrification, as they contain a slow-acting base in the form of iron rust ;

e) gypsum is a slow form in which to apply lime ;

f) superphosphate may prove a useful aid to nitrification on some soils ;

g) salt delays nitrification ;

h) sour soils are very unfavorable to nitrification ;

i) ploughing in of green or fresh stable manure may cause a temporary shortage of nitrates, particularly on damp soil.

In conclusion, some further experiments showed, that the nitrifying organisms are weakened by continued drought, and where the surface soil becomes unduly parched in a dry spell, nitrification will begin slowly after rain comes.

1397 – The Microbiological Causes of the Favourable Action of Sulphur on the Soil.

BOULLANGER, E. and DUGARDIN, M. Mécanisme de l'action fertilisante du soufre. — *Comptes Rendus des Séances de l'Académie des Sciences*, Vol. 155, No. 4, pp. 327-329. Paris, July, 22, 1912.

The favourable effects of sulphur applied to the soil had already been reported (1). The writers had then made out that these were probably due to an action exercised on the micro-organisms in the soil, and in order to elucidate this question they undertook the present experiments.

In the first place applying flowers of sulphur in various proportions to Omelianski cultures of nitrous and nitric bacteria, only a slight favourable effect on them was observed with small amounts, while large amounts were found to be injurious. With water containing 5 per cent. of peptone, in which some soil was stirred up, five days' incubation at 30°C. gave the following :

	Ammonia mgr. per 100 cc.
Control	141.9
Sulphur, 10 mgr.	147.8
" 20 mgr.	152.5
" 30 mgr.	180.7

It is clear that sulphur promotes the activity of the ammonifying bacteria, which is confirmed by two other experiments. In the one, sulphur was applied to 500 gr. of soil, kept for 10 days at 30°C., and in the

(1) See No. 760, *B.* May 1912.

other to 500 gr. of soil to which was added 0.4 gr. of nitrogen in the form of dried blood. The following are the results :

		Ammonia: mgr per kg. of dry soil	Nitric anhydride: mgr. per kg. dry soil	Total nitrogen: mgr. per kg. of dry soil
Soil	control	4.07	523	—
	sulphur 20 mgr.	6.65	543	—
Earth and dried blood	control	134.6	720	1 737
	sulphur 20 mgr.	203.2	712	1 737

It appears therefore that the sulphur has no influence on the nitrogen-fixing bacteria (*Azotobacter, Clostridium pasteurianum*, etc.) nor on the de-nitrifying bacteria.

In conclusion therefore it may be held that the favourable action of flowers of sulphur on the soil is due to the stimulus produced on the bacteria which decompose the complex nitrogenous substance into the ammoniacal state, and likewise in part on the nitrifying bacteria. The plants in this way obtain larger quantities of ammoniacal salts for assimilation, thus producing bigger crops, in a similar way to what takes place with sulphate of ammonia. It should be noted however that these ammoniacal products arise exclusively from the nitrogenous substances of the soil itself when the consumption is not made good by the application of organic nitrogenous substances.

TILLAGE AND METHODS OF CULTIVATION

1398 – **The Use of Explosives in Agriculture.**

JOTTRAND, V. L'emploi des explosifs pour l'agriculture et le défrichement des forêts. — *Journal de la Société Centrale d'Agriculture de Belgique*, Vol. LIX, Nos. 8-9, pp. 230-240. Bruxelles, June-July 1912.

The writer recalls (1) that the use of explosives in work on the land is principally resorted to for the following objects :

1) increase of the moisture of the soil ;
2) displacement of the soil ;
3) correction and modification of the soil ;
4) planting of new fruit orchards ;
5) improvement of old orchards ;
6) draining of moist lands and marshes ;
7) excavation of ditches.

He then brings forward considerations in relation to the different explosives available in commerce for the farmer and planter, classifying them in the following order :

a) explosives on a basis of saltpetre, (gun powder) ;

(1) See No. 777, *B.* May 1912. (*Ed.*).

b) explosives on a basis of nitro-cellulose (percussion powder, gun cotton and smokeless powder);

c) explosives on a basis of nitro-glycerine (dynamite and its derivatives);

d) safety explosives on a basis of nitrate of ammonia (prepared by the Favier Explosives Company of Vilvorde, near Brussels, but now made likewise by other firms);

e) explosives on a basis of potassium chlorate.

Considering these products individually we have first of all gunpowder, which is not in the least degree suited for the above purposes, because it is of insufficient explosive power, and also because it decomposes on contact with the wet soil. Nitro-celluloses in turn, being more dangerous explosives, must be rejected unconditionally except for military purposes. Dynamite, based on nitro-glycerine, should be put aside as far as possible; nevertheless in certain cases (for instance the products of the Dupont Co. at Namur) they may be useful, but always subject to all those precautions which form so great an obstacle to the farmer. So-called safety explosives (containing at least 80% of ammonium nitrate present every possible guarantee. Finally, with regard to explosives based on potassium chlorate, they have hitherto not been applied because they are too dangerous; nevertheless two preparations recently obtained appear destined to be of use.

In order to bring about the detonation of safety explosives, which as stated above are the most suitable, it is necessary that in the cartridge, the part not struck in percussion must be enclosed within resisting walls in order to act on the explosion of the detonator, which represents the sole danger in the use of these explosives; for this reason electric detonators, although more expensive, are from this point of view better, being safer, and allowing the operator to get away more quickly.

Finally, the writer points out that the use of explosives, especially as substitutes for the more expensive process of irrigation in order to moisten the soil, yields noteworthy results in the countries (such as North America for instance) where the contrast between the dry and moist season is extremely pronounced; and consequently that their use should be different in other climates, for instance that of Belgium, for which their useful scope must be determined by experiments, which need not involve great expense.

1399 – **The Alterations of Calcium Cyanamide** (1).

MANURES AND MANURING

1. LIBERI, G., Sulle pretese perdite di azoto nella calciocianamide. — *Annali della R. Stazione Chimico-Agraria Sperimentale di Roma*, Series II, Vol. V. pp. 163-177. Rome, 1912,
2. ID. Sull'instabilità della forma cianamidica nell'azoto della calciocianamide. — *Ibid.* pp. 179-197.

(1) See No. 491, *B.* March 1912. (*Ed.*).

Calcium cyanamide, especially if it is in a more or less moist medium, absorbs a certain amount of water and carbonic acid which go to increase the weight, and result consequently in a reduction of standard ; it is doubtful, however, whether in correspondence herewith a real and genuine loss of nitrogen must be assumed to take place.

Taking up this question the writer has carried out a series of researches on three specimens of calcium cyanamide kept for periods of 25 and 50 days, both in a dry and a moist medium. The losses of nitrogen were estimated, directly by collecting and ascertaining the quantity of ammonia given off during the experiment ; indirectly, by making a determination of the nitrogen before and after the experiment, with an innovation in the method inasmuch as the determinations made after the experiment were carried out on quantities of material weighed before the experiment, and afterwards submitted *in their entirety* to analysis, so as thus to obtain the real and actual loss of nitrogen, independently of any variation of weight undergone by the fertiliser. In both cases the specimens were kept in bells through which a slow current of air driven by a fan passed.

The results obtained show that calcium cyanamide does effectively undergo a loss of nitrogen, which, however, even in a moist medium is very small. In this experiment the material was spread out and broken up, so that it had a large surface exposed to the action of the moisture which causes the loss of nitrogen, while under real practical conditions this does not take place, nor is the material kept in media saturated with moisture ; for this reason, the writer is of opinion that in practice the losses to be apprehended will be almost nil or very small, especially if the medium is not very moist.

In a second series of enquiries carried out on the same materials and under the same conditions, the writer concerned himself with the variations undergone by nitrogen in the cyanamide form. From the results he notes that nitrogen in this form undergoes constant diminution in the course of time ; this diminution, though small in a dry medium, increases considerably in the open air, and may result in the almost entire disappearance of the cyanamide form in a moist medium. He therefore thinks that in calcium cyanamide the progressive conversion of the nitrogen in the cyanamide form into other forms, which remain in the manure, is produced by the action of moisture.

Finally, in a third series of investigations, the writer studies the course of this transformation in the aqueous solution of calcium cyanamide, likewise extending his attention to the dicyandiamide form. He works with concentrations of 1% and 5% at a constant temperature of 27°C. The percentage of cyanamide and dicyandiamide nitrogen, determined at various intervals of time, are summed up in a table and represented graphically in two diagrams which show :

1. That the cyanamide form diminishes continuously until complete disappearance, with greater speed in the more concentrated solution.

2. That the dicyandiamide, which is nil or almost nil at the start grows rapidly to a maximum, after which it diminishes continuously, and the phenomenon is more pronounced in the more concentrated solution, in which the formation of dicyandiamide is greater.

A notable fact in these solutions is the formation of crystals of calcium hydrate, while the formation of ammoniacal compounds does not take place ; a mixture of two or three different crystalline forms of deliquescent nitrogenous compounds, melting below 100° C., which was isolated from the solution, appears to contain the final forms into which the nitrogen of the calcium cyanamide passes. It must be held, therefore, that the conversion of the cyanamide in the soil must not be attributed exclusively to physico-chemical causes determined by the presence of zeolites and colloids in general, but must in great part be due to the action of the calcium present in the substance.

1400 – The Degradation of Phosphatic Manures during a Three-Year Rotation.

1. MUNTZ, A. and GAUDECHON, H. La dégradation des engrais phosphatés au cours d'un assolement. — *Comptes Rendus des Séances de l'Académie des Sciences*, Vol. 155, No. 4, pp. 257-260. Paris, July 22, 1912

2. ID. La dégradation des engrais phosphatés au cours d'un assolement triennal. *La Vie Agricole et Rurale*, No. 37, pp. 285-286. Paris, August 10, 1912.

One of the most important problems in the practical employment of manures is that of the permanency of the activity of chemically treated phosphatic manures during an entire rotation ; that is whether it is advisable to give all the phosphorus required in a rotation or even more than is necessary to the first crop.

To test this point the writers have conducted a series of experiments in pots with five three-year rotations plus a second crop each year. Five groups of four pots were taken, each containing 50 kg. (almost 1 cwt.) of earth ; to three were added 4.36 gr. of phosphorus (equivalent to 10 gr. of P_2O_5) as superphosphate (monocalcic), precipitated phosphate (dicalcic) and precipitated phosphate (tricalcic) respectively ; the fourth (control) pot contained 21 gr. of phosphorus previously present in the soil.

Each series had a separate rotation, and the phosphatic manure was mixed with the soil at the beginning. At the end of the second year a dressing of nitrogen and potash was given. The amount of phosphate given corresponded to 4 3/4 cwt. of P_2O_5 per acre, a heavy dressing.

Putting the main crops and catch-crops together, the following results are obtained with the different phosphatic manures over the three years, there being five pots for each manure. The table shows the dry matter (at 100°C.) produced and the P_2O_5 removed.

	Monocalcic phosphate		Dicalcic phosphate		Tricalcic phosphate		Control	
	Dry matter produced	P_2O_5 removed	Dry matter produced	P_2O_5 removed	Dry matter produced	P_2O_5 removed	Dry matter produced	P_2O_5 removed
	gr.	gr.	gr.	gr.	gr.	gr.	gr.	gr.
Year I, 1908 . .	2 788.9	21.65	2 330.2	18.82	2 541.3	18.18	1 779.7	10.40
Year II, 1909 . .	1 873.8	10.80	1 739.9	9.85	1 609.2	8.58	1 412.9	6.42
Year III, 1910 . .	1 204.5	5.32	1 286.0	5.34	1 358.5	5.82	1 237.0	5.52
Total . . .	5 867.2	37.77	5 356.2	34.01	5 509.0	33.22	4 429.6	22.34

These results show that the phosphates, and in particular superphosphates, give rise to a substantial increase of crop and a large absorption of phosphoric acid in the first year ; in the second these effects are less and in the third not appreciable, the results being equal to those of the control. This indicates that the phosphoric acid has undergone modification, losing its fertilising power and acquiring instead the inertia of that previously present in the soil.

The conclusion is that it is sound practice not to apply easily assimilable phosphatic manures in large quantities to do for an entire rotation, but to use them every year as required, like the quick-acting potash and nitrogenous manures.

1401 – The Utilisation of Silicates of Potash.

1. PRIANISHNIKOFF, D. Vegetationsversuche mit verschiedenen kalihaltigen Mineralien. — *Die landwirtschaftlichen Versuchs-Stationen*, Vol. LXXVII, Parts V and VI., pp. 399-411 + plates II - VI. Berlin, 1912.

2. BLANK, E. Die Glimmer als Kaliquelle für die Pflanzen und ihre Verwitterung. Arbeiten aus dem Agrikultur-chemischen Institut der Universität Breslau, III. — *Journal für Landwirtschaft*, Vol. LX., Part II, pp. 97-110. Berlin, 1912.

1. The Author reminds us that in Russia (1) agriculture chiefly makes use of phosphoric acid, after which comes nitrogen, and lastly potash.

(1) See No. 898, *B.* June 1912 ; No. 1280, *B.* Sept. 1912. (*Ed.*).

For phosphoric acid sufficient sources exist in the shape of natural phosphate deposits, basic slag and bone meal; for nitrogen there are the great reserves of the black soils with their high nitrifying power; as regards potash however sufficient sources of supply are not known, hence the necessity of importing the salts from Stassfurt, and the desirability, especially for more remote regions, of the utilisation of any silicate of potash which may exist there.

From the present culture experiments, in continuation of the previous researches of the Author and other Russian investigators, the following general conclusions are arrived at:

a) Among silicates of alumina, there are some which form fairly considerable sources of potash while others are quite incapable of utilisation.

b) The materials tested may be arranged in the following decreasing order of utilisation:

Good — nephelinite, mica schist, biotite.

Mediocre — phillipsite and muscovite.

Bad — nephelime (eleolite), leucite, apophyllite, sanidine, orthoclase and microcline.

The Author next endeavoured to determine the aptness of these minerals and the corresponding parent rocks for the basic interchange which is held to be a property of hydrated silicates, and also holds good, according to Glinka, for the anhydrous solicates. In point of fact the experiments carried out with solutions of ammonium and barium chloride of 10 % strength go to confirm this, yielding results in keeping with the foregoing in the course of culture experiments.

2. In reference to this matter some conclusions drawn by Blank must be noted. Starting from the investigations of the foregoing writer and others, and examining critically these experiments and his own cultures, he deduced that:

a) Both muscovite and biotite yield up potash to plants, constituting more suitable sources of potash than felspars.

b) The fresh supply of potash to plants from muscovite would appear to be in contradiction with the common opinion of the non-degradable character of this mineral; the phenomenon, however, would appear to consist in an elimination of potash without apparent alteration in the external physical characters of the mineral.

1402 – City Street Sweepings as a Fertiliser.

(1) SKINNER, J. J. and BEATTIE, J. H. — *U. S. Department of Agriculture, Bureau of Soils, Circular*, No. 66, 8 pp. + IV tables + 2 figs. Washington, 1912.

(2) ID. An Examination of City Street Sweepings. — *The Journal of Industrial and Engineering Chemistry*, Vol. 4, No. 8., pp. 604-606 + tables IV + figs. 2. Easton, Pa., August, 1912.

The value of street sweepings is a matter that is of interest to officials of all the large cities. The débris which is collected from the streets of cities is commonly used as fertilising material, being sold to near-by gardeners, truckers, and farmers, its rather low cost making it particularly attractive. The main object of the city official is to dispose of the material; in some cases it is burned and in others it is hauled to a dumping ground and used as filling material. This circular deals with an investigation of the street sweepings of one of the larger cities. The material has been studied from the point of view of its organic and inorganic constituents and through cultural tests.

Chemical examination for mineral constituents. — Three sauples of the sweepings were examined : sample no. 1 consisted of the débris secured by hand sweeping with a brush, sample no. 2 was that secured by sweeping with a machine, and sample no. 3 was the decomposed débris from a dump pile which had been accumulating for some length of time.

Analysis of Street Sweepings. *

	Nitrogen per cent	Potash per cent	Phosphoric acid per cent
1. Hand swcepings	1.34	0.71	0.03
2. Machine "	0.86	0.86	0.55
3. Decomposed "	0.60	0.56	0.60

* Based on dry mterial.

These amounts may be compared with the averages for stable manure: nitrogen, 1.6 per cent. ; potash, 1.5 per cent. ; phosphoric acid, 1 per cent. (*Storer, F. H.* Agriculture in some of its relations with Chemistry).

Effects on growth. — The effect of the sweepings on the crop, especially when used year after year on the same fields, is one of much interest and has caused considerable speculation. To test this effect, wheat and corn were grown in paraffine wire pots for one month ; the soil used was a clay loam ; and the sweepings and manure were used at the rate of 5 tons per acre.

EFFECTS OF STREET SWEEPINGS.

Growth of wheat in soil treated with street sweepings and stable manure.

Treatment	Green weight Gr.	Increase per cent.
Soil untreated	1.708	—
Soil + hand sweepings	2.240	31
„ + machine „	1.880	10
„ + decomposed „	1.800	5
„ + stable manure	2.500	46

Growth of corn in soil treated with street sweepings and stable manure.

Soil untreated	3.700	—
Soil + hand sweepings	4.710	27
„ + machine „	4.160	12
„ + decomposed „	3.440	8
„ + stable manure	4.950	34

Another culture test was made using a vegetable (radish). Again, as in the case of wheat and corn, the sweepings were beneficial, the treatment with decomposed sweepings showing the least effect, but stable manure had a more beneficial effect than the best of the sweepings.

Mineral oil in sweepings. — It is pointed out, that the sweepings, are apt to contain lubrificating oil and fine particles from the decay of the paving materials, and this may be especially true at the present time when the use of power vehicles is so extensive. Three samples were extracted with petroleum ether and the amount of oil extracted determined. The samples contained from 1.7 to 2 per cent. of crude mineral oil.

The effect of the oil extracted from the sweepings was tested with young wheat seedlings grown in distilled water and nutrient solution cultures ; 50 mgr. of oil from each sample were put in the 200 c. c. culture solutions. The oils were harmful to growth, the roots as well as the hops being affected ; oils from samples no. 1 and no. 2 reduced the growth of wheat 10 per cent. in the case of distilled water culture, and the oil from sample no. 3 reduced the growth 20 per cent ; in the nutrient solutions, the oil from sample no. 1 reduced growth 6 per cent., from sample no. 2, 7 cent., and from sample no. 3, 11 per cent.

Finally, the sweepings from which the oils had been extracted were tested as to their effect on growth.

Effect of Street Sweepings, after being extracted with Petroleum Ether.

Treatment	Green wheat gr.	wright of radish gr.
Soil untreated	1.910	3.700
„ + hand sweepings, extracted	2.270	5.400
„ + machine „ „	2.270	5.700
„ + decomposed „ „	2.190	5.200
„ + stable manure „	2.260	5.800
„ + stable manure, natural	2.270	5.700

These figures show that the action of street débris after removal of the oil from it was practically the same as that of the stable manure. That the oil is the deleterious constituent of the sweepings is also borne out by the above fact that the oil itself, when added to culture solutions markedly reduced the growth of the plants.

Conclusions. — The application of street sweepings will undoubtedly have a beneficial effect and be a factor in building up the land ; the possible danger of a harmful effect from the oily substance which it contains must, however, be considered. If the oil could be economically extracted this danger would be averted. The oil in the débris for the first year or two may not have any effect, but a continuous application to a field year after year may eventually impair its productiveness, unless through drainage or other natural agencies the oily material is drained off or changed. In some localities this is probably the case, but attention must be called to the fact that the presence of an unusual amount of oil in such street sweepings has been the result of automobile traffic, and hence appears only in recent years as an appreciable factor in the use of street sweepings fertiliser.

Apart from the physiological action of the oily material mentioned, there are probably other more strictly physical effects due to the coating of soil particles, thus interfering with normal moisture movements and solubility of the mineral soil constituents. Vegetable or animal oils undergo changes in soils under the influence of organisms, but so little is known of their action on the strictly hydrocarbon oils that no statement concerning the possible disappearance or change of them in street sweepings can be made.

1403 - The Present Consumption of Manures in France.

1. SAGNIER, H. Chronique agricole : Consommation des engrais. — *Journal d'Agriculture Pratique*, 76th. year, Vol. II, No. 34, pp. 232-233. Paris, August, 22, 1912.

2. *République Française, Ministère des Finances, Direction générale des Douanes. Documents statistiques sur le Commerce de la France, Six premiers mois des années* 1910, 1911 *et* 1912. Paris, 1912.

Henry Sagnier remarks that among indications of agricultural activity the trade in manures is one of those which best enable us to gauge the greater aggregate of work put out by farmers. In this connection he points to the monthly statistics of the administration of French customs, from which sufficiently precise data may be obtained and some practical conclusions consequently drawn especially as to the trade in chemical manures in France.

Thus in the first half-year of 1912 the imports of mineral phosphates, originating almost exclusively from Tunis, amount to 429 900 tons as against 371 200 tons for the corresponding period in the preceding year. These phosphates are mostly used for the manufacture of superphosphate, chiefly for home consumption, but to some extent for export also : for the period under consideration, as against an importation of superphosphate of 73 837 tons, there is an exportation of 92 826 tons. The imports of nitrate of soda total 234 400 tons with an increase of 32 400 tons over the same period in the two preceding years. Nitrate of lime and cal-

cium cyanamide aggregate 439 tons in 1910, 1557 tons in 1911 and 1585 tons in 1912. There is also a growth in the amounts of the principal potash manures : thus, in the case of sulphate, 11 220 tons against 10 930 tons, and for chloride 33 860 tons against 24 800 tons. Sulphate of ammonia is practically stationary, 9 450 tons in 1912 against 10 430 in 1911. Finally as to chemical manures which are not enumerated and organic manures, the imports and exports practically balance each other.

In conclusion, a comparison with previous years indicates clearly the continuous progress in the consumption of mineral products as agricultural fertilisers, so much so that for the majority of them the exports may be neglected, attaining real importance, as we have seen, only for the superphosphates. Naturally, as Sagnier points out, the particulars given by customs statistics are not complete ; in the case under consideration for instance, iron slag is lumped together with phosphatic slag, of which there appears in 1912 an importation of 28 450 tons against 23 220 in 1911. Nevertheless these particulars are for the moment sufficient to outline clearly the present day tendencies in the consumption of chemical fertilisers in France.

1404 – **Further Agricultural and Manuring Progress in Japan** (1).

TANIMURA, ISSA (Commissioner of Live Stock for Japanese Government.). Agriculture and Fertilization in Japan. *Commercial Fertilizer*, Vol. V. No. 1, pp. 26-27. Atlanta, Ga., Aug., 1912.

Pending publication of the results of the latest investigations by the Japanese Ministry of Agriculture and Commerce as to the consumption of fertilisers in Japan, it is of practical interest to reproduce some considerations submitted by Dr. Tanimura to the last meeting of the American National Fertilizer Association in Atlantic City, July 15-19, 1912.

After the peace with Russia the Japanese Empire comprised an area of 173 900 square miles with a population of about 60 000 000 inhabitants. Of the total area only 25 per cent. was cultivated, 9.5 per cent. under rice, 8.5 per cent. upland field, and 7.5 per cent. pasture and plains of which, one-third is used for raising weeds for manure and another third for fodder, while the rest is pasture and jungle. At the present time there are about 1 250 000 cattle, 1 500 000 horses, 320 000 swine, 800 000 goats and 4 000 sheep. Owing to the deficiency of modern agricultural implements and machinery, and also the scarcity of domestic animals, the Japanese are eager to import a large amount of reliable and up-to-date manures, particularly from America, to grow more grain and feeds for animals.

The Japanese farmers, have been in the habit of depending on animal manures. Barnyard-manures, weeds and wood ashes are also considered

(1) See No. 1023, *B.* July, 1912. (*Ed.*).

important. Green manures in the form of grasses, weeds, leaves, sea-weed and refuse are extensively used. Twenty years ago oil cakes, fish guano and rice bran were much used, and there are still imported from China for this purpose $ 8 000 000 worth of bean cakes. Up to a short time ago cattle in Japan were bred for work and the production of manure, but at present the country is becoming more and more a consumer of meat and milk, for which reason the consumption of chemical fertilizers will be still further increased.

Superphosphate has already yielded excellent results and considerable quantities of phosphate rock have recently been imported from the United States, as likewise bone meal, tankage and compound manures (1).

To sum up, the limitation in the manures hitherto used, the probable extension of cultivation from 25 per cent. to 75 per cent. of the Japanese territory, the intensification of this cultivation, especially as regards fodder plants, in consequence of the increase of population and the cost of living — are as many reasons for agricultural progress which justify the anticipation of a sustained importation of chemical fertilizers into Japan.

AGRICULTURAL BOTANY
CHEMISTRY AND PHYSIOLOGY OF PLANTS

1405 - **The Chemical Composition of the Water-melon.**

1. SHERVIN, C. P. and MAY, C. E. (Department of Chemistry, Indiana University, Bloomington). Concerning the Sugar Content of Watermelons. — *The Journal of Industrial and Engineering Chemistry*, Vol. 4, No. 8, pp. 585-588. Easton, Pa., August 1912.
2. Wassermelone — *Konig's Chemische Zusammensetzung der menschlichen Nahrungs- und Genussmittel*, IV Year, pp. 1496-1497.

The literature on the sugar content of watermelons is comparatively meagre. Investigations have been made by Wiley and Payne on the sugars and the ash of American watermelons, and also by Jaffa in California, and Nardini in Italy.

Messrs. Shervin and May have studied the sugars in the expressed juice of specially sweet melons, dealing also with the alcohol and acetic acid produced by the fermentation of the juice, and, subordinately, the determination of the ash likewise.

From the data obtained it appears that the melons studied contained 43 per cent. of juice, 47 per cent of rind and 10 per cent of pulp. The ash content of the juice was near 0.25 per cent.; of the ash one-eighth was insoluble. Reducing sugars measured gravimetrically were found to be about 5.5 per cent. of the juice, and measured by polarisation, something less. Sucrose was generally found to be more than 1 per cent. The quantity of pentose in the sugar would appear to be very small.

(1) To be noted is the importation of sulphate of ammonia from England, which exceeds any other item in amount. Cf. *Mark Lane Express and Agricultural Journal*, Aug. 16, 1912 (*Ed.*).

Finally, the sugar juice yielded a liquid with 2.5 per cent. of alcohol by weight, and from this by further fermentation could be obtained a solution with 1.75 per cent. of pure acetic acid.

1406 – The Formation of Fatty Matters in Oleaginous Plants.

1) SCURTI, F. and TOMMASI, G. Sulla formazione del grasso nei frutti oleaginosi. Nota II Ricerche sperimentali sul ligustro (*Ligustrum japonicum*). — *Annali della R. Stazione Chimico-Agraria Sperimentale di Roma*, Series, II, Vol. V (1911), pp. 103-121.

2) SCURTI, F. and FORMAINI, M. Id ; Nota III. Ricerche sperimentali sulle foglie di ligustro. — Ibid., pp. 223-239.

In a preceding article (1) the two first-mentioned writers put forward the idea, that the formation of fatty matter in the mesocarp of the olive differs essentially from the processes leading to similar results, which take place in oleaginous seeds and in the stems of woody plants. Probably, this formation is effected according to the following phases of the process :

I. Influx of waxy matter (oleanol).

II. Formation of fatty acids.

III. Formation of glycerides (fatty matters).

This process does not appear to be a synthesis, but rather, a partial disintegration of waxy compounds, which are very rich in carbon.

In studying the fruit of the Japanese privet (*Ligustrum japonicum*), which belongs to the family of Olaeceæ, and is very nearly related to the olive, the writers of the first article come to the same conslusions. The ligustrol corresponds to the oleanol of the olive. In both cases, before the formation of glycerides, the appearance is observed of free fatty acids, which are subsequently gradually etherized ; in the olive, these are oleic acid associated with a low percentage of limolic acid, and palmitic and stearic acids ; in the case of the Japanese privet, we have erucic, palmitic and stearic acids.

The writers of article 2 have investigated the products elaborated by the leaves of the Japanese privet and have also dealt with the composition of the fruits. The direct analysis of the leaves gives the following results :

1) There is, in the leaves of the Japanese privet, as in those of the olive, at least during the period of the investigation, an uninterrupted formation of compounds soluble in ether, which from September to December amount to from 5.75 to 7.35 %.

2) The highest percentage of fatty matters is found in December, *i. e.* at the conclusion of the process of oil formation ; before this time, that is to say, from August to November, the leaf becomes perceptibly poor in these products ; this shows that, while in the olive, the amount of fatty

(1) See No. 1114, *B.* April 1911. (*Ed.*).

matters formed during this period is such that it is found in increasing quantities, in spite of its continual afflux to the fruit, the smaller amount produced in the leaves of the Japanese privet, causes a certain disturbance in the equilibrium between its formation and its removal.

3) The lower content in fatty matters of the leaves of the Japanese privet compared to those of the olive, corresponds to the lower percentage of fatty matter contained in the fruits of *Ligustrum japonicum* compared with those of *Olea europaea.*

4) With regard to mineral substances, the leaves of the Japanese privet are distinguished by an unusual amount of ash, which, like that in the olive leaves, showed no perceptible variation during the different periods of observation.

Amongst the products soluble in ethyl ether is found as the principal product ligustrol, (the waxy alcohol of the fruits) a true wax analogous to that of the fruits, a resin, traces of essential oil, etc. In the so-called nitrogen-free extract, reducing and non-reducing sugars have been met with in the proportion of about 5 %; a mannite, inosite and starch in small quantities; and tannic, citric and malic acids in relatively large quantities.

Amongst the elaboration products of Japanese privet leaves, is thus found the waxy alcohol, which subsequently occurs in the fruits associated with fatty acids; and as the writers exclude *a priori* the participation of the above substances forming the nitrogen-free extract in the formation of fatty matters (oils), *a fortiori* they conclude that ligustrol plays the chief part in the formation of the fatty matters. The process of oil formation in the privet fruit is thus exacly similar to that taking place in the olives. In both plants the waxy alcohol is produced in the leaves, whence it passes by means of the shoots and the peduncles to the fruit. There, enzymic oxidation transforms it into fatty acid and later into a glyceride. As a result of the data obtained the writers have arrived at the following general conclusions. It is known that the leaves of different plants contain very different percentages of compounds soluble in ether, which proves that the capacity of plants for producing compounds of a fatty nature is very variable. On the other hand, botanists have often observed that certain leaves, among which are included those of the Oleaceæ, even during active assimilation, do not succeed, at all events after flowering, in forming a perceptible amount of starch in their chloroplasts; which substance, conditions being equal, accumulates in most plants in a considerable quantity. Thus, the fact that starch is only found as an ultra-secondary product in these plants, which have a special aptitude for forming fatty matters, shows clearly that a change takes place in the chlorophyll activity; the chief productive work of the leaves thus lies in the manufacture of fatty matters, rather than in that of carbo-hydrates. And if this is the case, it is prob-

able that where an inaptitude for starch formation is observed, we have to do with a similar condition of affairs and,in place of starch, a corresponding quantity of fatty matters is being produced. The demonstration of such an equilibrium will prove a valuable contribution to the interesting investigation of the chlorophyll activity of green plants.

From the point of view of the immediate practical application of this fact, it must be borne in mind, that *Ligustrum japonicum* contains fatty matters which, if the plant were more grown, could be obtained in large quantities. Thus, the waxy products could certainly be turned to account ; but in particular the erucic acid ; this in addition to being of value as a fatty substance, is used at the present day in some pharmaceutical preparations; Japanese privet fruits are considered the best of the very few origins of this substance.

1407 – **Influence of Light on the Flowering of Japanese Hop and Hemp.**

TOURNOIS, J. Influence de la lumière sur la floraison du Houblon japonais et du Chanvre. — *Comptes Rendus des Séances de l'Académie des Sciences*, Vol. 155, No. 4, pp. 297-300. Paris, July 22, 1912.

Some anomalies in the flowering of hop and hemp observed on plants sown prematurely or grown in hot-houses led the Author to study the various physical factors as regards the part they play in this phenomenon of abnormally early flowering. This note deals more particularly with the influence of light in view of the fact that the amount of light received by plants grown in winter is much below that received during normal growth, to which fact the writer attributes the early flowering. With plants grown in winter in hot-houses sown on the 8th. and 28th. of January, using two lots of seeds of different origin, he succeeded in proving that the precocity is the more pronounced in proportion as sowing has been more premature. In regard to both hemp and hop, flowers occurred on individuals still less grown than had been those in the previous experiments ; and while in the earlier experiments only part of the plants had flowered, in this experiment almost all the plants flowered at latest in April.

The writer further obtained early flowerings with plants sown at normal times by reducing the time of exposure to light. It may therefore be stated that within the limits of the experiment carried out, and under analogous conditions of temperature, the flowering of hemp and Japanese hop is earlier in proportion as the amount of light received by the plant from the moment of germination is less.

Some other observations were made by the writer in relation to the sexual anomalies of these early flowers. They were more frequent in prematurely sown winter plants than in those sown in April and June ; these latter indeed, save for a few rare exceptions, all yielded normal early flowers. Therefore these anomalies must be attributed to other concurrent causes,

as for instance the temperature and the hygrometric state of the air. Experiments now in progress will furnish more precise particulars on this point.

SELECTION

1408 – **Concerning the Necessity for Plant Types Resistant to Drought in Russia:**

BENSIN, V. Plemennoie Rastenievodstvo i Zasukho-ustoichivosti. — *Trudy Imperatorskago Volnago Ekonomicheskago Obstchestva.* (Work of the Imperial Free Society of Economics.). Nos. 1-2, pp. 51-64., St. Petersburg, 1912.

Xerophily is a form of adaptation characterised by more or less distinct anatomical and morphological features. Among the morphological charcters of xerophilous races the following may be indicated :

a) Reduction of the transpiration surface, with a diminution in the number of the leaves and the area of the limbs (for instance, the American drought-resisting lucerne).

b) Appearance of a waxy layer covering the epidermis (in sorghum for instance).

c) Growth of trichomes on the limbs of the sheath (for example in maize).

d) Characteristic movement of the limbs, especially in gramineous plants. The angle formed by the limb with the culm may vary from 90° down to 30°, insolation in this case being reduced nearly one half.

Among anatomical characters mention may be made of the following :

a) Strong growth of the veins.

b) Growth of the palisade tissue.

c) Reduction of the anatomical co-efficient, *i. e.*, the number and size of the stomata.

The losses occasioned by drought in Russia grow more serious from year to year. Hence the necessity for producing plant types possessing powers of resistance to drought, on the following method :

1) The laying down of a vast programme of experiments to be carried out in the various localities of the Empire.

2) The introduction of and attempted acclimatisation of resistant species grown abroad.

3) The selection of " local forms " distinguished by any of the xerophilous characteristics summarised above.

4) The arrangement of annual shows and competitions, with prizes or subsidies to the producers of the best xerophilous races.

1409 – **New Directions in the Work of the Selection of Maize.**

ROSEN, I. Novoie Napravlienie v Selekzionnoi Rabotie s Kukurusoi v Soedinennekh Statakh. — *Khosiaistvo* (The Farm), Year VII, No. 31, pp. 1013-1020. Kiev, August 9, 1912.

The problem of the utilisation of the grains of the first generation of hybrids of maize, as the sowing material for the purpose of increasing the yield, is attracting the attention of selectors more and more. It will

therefore not be out of place to recall the fact that the matter here in question is not the system already known of obtaining seeds from plants fertilised by cross-feritilisation within the limits of the same type, but of continued and repeated crossing between individuals belonging to pure strains (each strain derived from a single self-fertilised parent plant) of two different types.

In the first case the object is not cross-breeding but simply the prevention of self-fertilisation, which, indeed, is found very difficult even by compliance with the most complex rules and instructions in cultivation.

In the second case, on the contrary, in order to keep the two strains pure, self-fertilisation is advisable for the individuals of each strain, so that the material afterwards obtained by crossing may have the real meaning and value of hybrids. We may now set out the following rules and considerations.

1. The descendants of a self-fertilised plant are always less developed and productive than the descendants of plants naturally exposed in the fields to cross-fertilisation ; this is true both of superior individuals and individuals interior in point of productivity to the average of the type to which they belong.

2. The greatest diminution in the growth and yield in consequence of self-fertilisation is found in the first generation, falling off gradually in the subsequent generations down to a constant value.

3. The pure strains (or self-fertilised, coming from a single parent plant) are distinguished, among themselves by transmissible morphological characters.

4. The retrogression of the fluctuating characters is observed with greater frequency in proportion as we get farther away from the " mean morphological type " characteristic of a " pure strain."

5. The crossing between " brothers " and " sisters " (between male and female inflorescences respectively of two plants coming from a single parent plant and belonging to the same generation) presents no advantage over self-fertilisation.

6. Crossing between two self-fertilised strains of different types yields a progeny which is not inferior in force of growth and productivity to the plants never subjected to self-fertilisation.

7. In crossing two self-fertilised strains, the results from the reciprocal crosses are identical.

8. The seeds of F_1 obtained by crossing pure strains according to a determined scheme (combination), always exceed in yield the sowing material produced by irregular pollination in the fields, from which the two strains themselves were derived.

9. The productivity and morphological characteristics of the hybrids of the first generation are therefore a function of that specified combina-

tion of pure strains, and are constantly repeated when the crossing is renewed.

10. In the first generation of hybrids (F_1) the degree of variability of the individuals is not greater than that observed in the pure strains from which such generation sprang.

11. In the second generation of hybrids (F_2) the degree of variability is higher than in F_1.

12. The productivity of F_2 is lower than that of F_1.

The following examples illustrate these points:

Pure strain A	8 quintals per hectare	
" " B	7 "	"
(A × B) F_1	40 "	"
(B × A) F_1	40 "	"
(A × B) F_2	31 "	"
(B × A) F_2	38 "	"

Parents.	Increase of crop of the hybrids of the first generation reckoned as percentages of the average yield of both parents
Kopy × Chinese	126%
Mexicano × Chinese	114%
Brownswill × Chinese	100%
Kopy × Algerian	79%
Maryland × Kopy	29%
Chinese × Tom Thumb	0%
Guatemala × Salvador	14%
Mexicano × Tom Thumb	0%
Quarantino × Brownswill	8%
Brownswill × Guatemala	9%

In the great majority of cases therefore the hybrids of the first generation give a far higher yield than either of the pure strains from which they spring. This superiority, however, becomes rapidly attenuated from generation to generation.

What practical suggestions to the farmer may be derived from these facts? It is requisite in each specific locality to ascertain which is the most productive combination of pure strains (of two different types), and once this is ascertained, to keep and propagate the pure strains on special plots, producing year by year the necessary hybrid seed. The strains A and B may likewise both be kept on a single parcel of land, sowing in alternate rows. The rows of one strain, for instance A, are topped in the same year, and from these the hybrid seed material is obtained, while the plants of row B supply the caryopses (for two years) required for the preservation and propagation of strain B. In the subsequent year an opposite plan

is followed, obtaining from B the hybrids of the first generation and from A the sowing material for the pure strain A.

When selecting the two varieties to be crossed it will always be desirable to choose types which flower simultaneously; it is indeed always possible to make the flowering phases coincide by shifting the time of sowing.

It should likewise not be forgotten that:

1. By crossing types having grains of different colours the hybrids of the first generation give us at once variegated ears, which may reduce the market value. If for instance a white variety is crossed with a yellow, as the first result yellow ears are obtained (yellow is a dominant feature as compared with white.). But the grains thus obtained, and sown for the purpose of producing the hybrids of the first generation, give us many specimens with vari-coloured ears and some with white ears (one quarter according to Mendel's second law of segregation of characters).

2. The same phenomenon takes place on crosing horse-tooth varieties with varieties of sweet maize. The spikes produced direct by the crossing give us exclusively grains of the horse-tooth type (dominant character), which however, when sown, produce specimens with spikes containing grain both of the maternal and the paternal type.

3. Finally, we see to what we have to attribute the effects (reduction of yield) of self-fertilisation. That it is not a question of true and genuine degeneration is proved by the fact that in self-fertilised strains all the organs are normally developed; there is only some reduction in the intensity of the process of growth. It seems therefore that cross-fertilisation of maize stimulates the vital processes, a stimulus which of course is wanting when the biotypes (pure strains), are isolated by self-fertilisation. There still remains open, however, the question whether the facts stand to each other in the relation of cause and effect or whether it is a matter of pure parallelism. In the present case it may happen that the most important part is represented by the organic substances which from the paternal cell pass into the maternal one, and not by the fact of crossing in itself.

1410 – Ear-Selection in Improving Maize Varieties.

MISEVIC, A. Opéti s otborom Pochatkov kukurusi v Zieliakh eià Ulucshenniia. — *Khosiaistvo* (The Farm), Year VII, No. 28, pp. 929-936, and No. 29, pp. 959-965. Kiev, July 26, 1912.

Some experiments were carried out in 1911 on the experimental farm of Irghen, Yekaterinoslaw Govt., as to the heredity of characters observed by sowing all the grains of particular ears of maize together. The varieties used were the American Sterling and Liming and the native Grushevsk. Two sowings were made (April 18-28 and May 10-12).

With Liming it was found that from the earlier sowing the heaviest parent ears gave the largest crop, the highest percentage of unripe ears and the lowest percentage of poorly developed ripe ears ; for the later sowing, the lightest parent ears gave the heaviest crop, with a low percentage of unripe and poorly developed ears. This is probably due to such individuals being earlier in maturing and consequently not subject to injury by autumn frosts.

With Sterling, the bulkiest and heaviest ears gave the biggest crop, but the proportion of unripe and ill-developed ears increased with the increase of crop.

Grushevsk gave similar results.

Selection gave no results with Liming. With Sterling the yield per plant was increased from 213 grams in 1910 to 258 gr. in 1911 ; the average number of ears per plant from 0.95 to 1.07 ; the average weight of the ear from 225 gr. to 241 gr. ; the percentage of early- ripening ears from 3.4 to 19.9 ; the average weight of early-ripening ears from 237 to 266 gr. ; the percentage of barren plants fell from 2.8 to 0.3. With Grushevsk the yield per plant rose from 168 to 229 gr. and the number of ears per plant from 1.05 to 1.47 ; the percentage of barren plants fell from 4.0 to 0.1.

CEREAL AND PULSE CROPS

1411 – **Experiments with New Varieties of Wheat in Umbria, Italy.**

CANEVARI, IGINO : Esperienze su nuove varietà di frumenti. — *L'Agricoltura Italiana*, Year XXXVIII, Part 727, pp. 492-497. Pisa, August 1912.

The writer wished to compare some varieties of wheat which stood up well with the varieties Germanello and Gentil Rosso grown at the farm of Casalina, belonging to the R. Istituto Superiore Agrario of Perugia. The varieties used for the experiments were supplied by the raisers themselves and are given in the following table. The soil chosen was of an alluvial nature of average compactness and rich in humus (the writer gives the mechanical and chemical analyses), and had been under a hoed crop the previous year.

Fifty-two plots of 24 sq. yds. each and two 18 sq. yds. were planted. Each variety was sown in two plots on Nov. 16 1911, and was harvested on June 30, 1912. In the accompanying table, the results obtained are included and the resistance to lodging was determined by cutting separately the plants which were lodged, measuring the area occupied by them and finding the proportion of this to the whole area occupied by this variety.

The maximum resistance is expressed by 10.

The earliest varieties to flower were Cascola and Ibrido Passerini. The varieties from cold districts were generally late and Rouge d'Ecosse (Scotch Red) was the latest of all. Hybride du Trésor and Miracle showed themselves resistant to lodging ; while on the contrary, this tendency was very marked in the Italian varieties. The best tillering was shown by the

VARIETY	Period from seeding to flowering — days	Resistance to lodging	Tillering	Rust attack	Yield per acre cwt. seed per acre 72 lbs.	Yield per acre cwt. seed per acre 108 lbs.	Bushel weight by Brauer balance lbs.
1 Saumur d'automne	185	7	v. slight	v. slight	7.7	9.7	63.8
2 Seigle	185	8	medium	none	12.1	14.4	61.3
3 Nonette de Lausanne	185	8	»	»	12.2	13.7	64.0
4 Rouge d'Ecosse .	188	7.5	»	v. slight	8.4	11.3	64.3
5 Barbu à gros grains	185	7.5	»	slight	9.7	12.8	64.3
6 Hybride hâtif inversable	184	8.5	»	v. slight	13.7	14.5	64.2
7 Noé bleu.	185	8	»	none	9.4	12.5	63.2
8 Hybride du Bon fermier	185	6	abundant	»	11.7	14.4	64.3
9 Miracle ou de Smirne	185	10	none	»	9.7	10.1	61.9
10 Stand-up	186	7	v. slight	»	9.0	10.9	63.8
11 Gros bleu . . .	184	5.5	medium	slight	13.7	16.5	64.6
12 Bordeaux rouge inversable . . .	185	7	»	»	8.4	10.2	64.5
13 Petanielle noire de Nice	182	8.5	»	none	12.0	12.9	61.4
14 Blé d'Australie. .	185	7	»	»	12.4	14.8	61.1
15 Blé di Pithiviers .	183	8.5	»	»	11.2	13.2	61.8
16 Prince Albert . .	187	6.5	»	v. slight	10.3	12.5	61.3
17 Hybride Briquet jaune.	187	7.5	abundant	none	10.3	12.7	61.6
18 Blé du Trésor . .	182	10	v. slight	v. slight	17.2	17.6	63.4
19 Dattel.	180	6.5	»	none	10.3	14.1	61.9
20 Lamed	180	6	»	»	13.2	13.6	63.7
21 Cascola	176	5	medium	»	10.4	12.2	63.2
22 Fucense duro . .	184	5	abundant	»	10.1	11.9	61.8
23 Calbigia (beardless Gentil rosso). . .	180	5	medium	considerab.	12.2	13.5	62.1
24 Germanello . . .	180	5	abundant	slight	7.6	11.3	65.1
25 Ibrido Passerini. .	176	7	»	none	10.0	12.5	62.4
26 Gentil bianco . .	180	3	medium	»	5.4	5.9	62.7
27 Rieti originario. .	180	5	abundant	slight	12.4	12.9	63.2

Italian varieties ; the Miracle did not tiller at all. Nearly all the varieties coming from damp and cold districts were highly rust-resistant and among the Italian varieties, Ibrido Passerini and Gentil bianco were immune.

The writer concludes by saying, that it will be necessary to prosecute the researches for some years before any definite conclusions can be drawn.

1412 - **Proposal for the International Uniform Valuation of Brewing Barley.**

WEINZIERL, THEO VON. Direktor der K. K. Samen-Kontrollstation in Wien. Vorschläge über die Internationale Einheitliche Beurteilung der Braugersten. Vortrag gehalten während des 2. Internationalen Brauer-Kongresses in Chicago. — *The American Brewer*, Vol. XLV, No. 8. New-York, August 1912.

At the Second International Brewer's Congress of Chicago the following methods of valuation for the examination of brewing barley were recommended by the Government Control Station at Vienne. Note is also taken of the so-called Vienna system of valuation employed at the Austrian government barley exhibitions.

The valuation takes place along two lines, a) *objective* and b) *subjective*.

Objectively, the barleys are examined with regard to the following properties :

1. Moisture content.
2. Hectoliter weight.
3. Absolute weight (1000 kernel weight).
4. Screenings (with shaking screen of 2.2 mm. mesh).
5. Impurities.
6. Real glassiness.
7. Husk content.
8. Nitrogen content (crude protein).
9. Germinating energy and capacity.

Subjectively the barleys are examined for :

1. Color.
2. Uniformity of berries.
3. Shape of berries.
4. Fineness of husks.
5. Odor.
6. Damaged berries.
7. General appearance.

Objective Examination.

The following are the methods employed in the objective examination of brewing barleys :

1. *Taking of samples.* The Komers-Frendl sampler is employed. Originally designed for sampling beet seed, this tool has been found to be very well adapted for taking grain samples.

The hectoliter weight is first ascertained. According to the size of the sample to be examined the contents of two to four segments are taken for finding the absolute weight, the impurities, the husk content and the real glassiness; of one segment for finding the water content and the nitrogen content.

2. *Hectoliter Weight.* Two examinations are made with the gauged grain sampler in quantities of 1 liter — with smaller samples ¼ liter — and the arithmetic mean is taken if the difference of the two examinations does not exceed 0.2 kg. per hectoliter. In all other cases a third examination is made. For pouring the different samples, a sheet-iron funnel with a large discharge opening should be used.

3. *Water Content.* 5 gr. of the sample are gound fine, dried, for two hours at 50° C, and then for three hours at 100° C.; then allowed to cool in the exsiccator, weighed and weight per cent calculated. Two such examinations are made, and the difference between them must not exceed 0.5 (0.3) per cent.

4. *Finding the Absolute Weight.* An average sample of ½ to 1 kg. is divided in the Komers-Frendl sampler into 10 parts. Two or three of these parts are freed from impurities and broken berries, united, weighed and counted. From the weight and the number of berries the absolute (1000 berry) weight is calculated to dry substance. For that purpose the moisture content is estimated in a finely ground sample.

5. *Screenings.* 100 gr. of the original sample are shaken on the Steinecker screen for five minutes and the weight per cent of the barley that falls through the 2.2 mm. mesh is found. The mean of three operations gives the screenings in weight per cent.

6. *Finding the Impurities.* — The content of one or two segments of the sample screen is divided, by the aid of spatula and pincers, into barley, broken berries, dirt and husks, also foreign seeds.

These parts are weighed and calculated for weight per cent. This operation is performed twice and the mean taken.

7. *Finding the Real Glassiness.* The barley is first prepared and then examined with the farinatome of Printz. The barley is first steeped in a chamber with rarified air for 24 hours, then evacuated for 1 hour and finally dried for 24 hours in rarified air. The operation with the Printz farinatome is performed twice and the arithmetic mean taken.

8. *Finding the Husk Content.* — This is done by the Luff method with 50 weighed berries. Two operations are always made, and where the difference exceeds 0.5 there should be three.

9. *Protein Content, Crude Protein.* — The nitrogen is estimated by Kjeldahl's method. Factor for calculation for protein = 6.25. Two parallel operations are made, which should not differ by more than 0.2 per cent of protein.

10. *Germinating Energy and Capacity.* — Twice 200 berries are steeped for 6 hours at room temperature, then laid in a damp germinating bed of double folded filter paper and allowed to germinate in the germinating box. They are first counted after 72 hours (including the steeping time) and the number calculated to 100 berries. The operation is ended after 6 days.

1413 - **The Cultivation of *Phaseolus Mungo* in Turkestan.**

SKORZOV. N. Mash *Phaseolus Mungo.* — *Selskii Khosiain* (The Farmer), Year XXVI, No. 30, pp. 1606-1607. S Petersburg, May 1912.

In Turkestan, a leguminous plant, *Phaseolus Mungo* is much grown. It is sown in spring, sometimes even in the middle of summer, after the barley or wheat is harvested. It bears roundish seeds of a dark green colour; they are of high nutritive value, while the leaves and haulms make excellent fodder.

The seeding is about 36 lbs. per acre, and the crop yields 90 to 110 lbs. of seed and 32 to 40 cwt of fodder per acre. The vegetative period, from the appearing of the seedlings to ripening, does not exceed three and a half months. This plant might be introduced into Southern Europe, and cultivated during the period intervenung between the cereal harvest and the commencement of autumn ploughing.

FIBRE CROPS

1414 - **Propagating Cotton Plants by Slips.**

GASTET, G.: Le Bouturage du Cotonnier. — *Revue Horticole de l'Algerie*, 6th. Year, No.5, pp. 144-148, 4 figs. Algiers, May 1912.

The selection of the cotton plant is very important and is sometimes useless when it is only practised upon the seeds, for the seeds of a plant known to be perfect may have been spoilt by fertilization with inferior pollen carried by wind or insects, and such seeds often give rise to imperfect plants. Thus, M. Trabut said at the last Cotton Congress at Orleansville "the multiplication by cuttings would have the great advantage of permitting the use of hybrids of the first generation, very fine plants, but degenerating on sowing."

The writer, after having tried to multiply the cotton plant by means of ordinary cuttings and failing, devised a technique for the process and used herbaceous slips. A figure in his article shows young slips no higher than the rims of the pots where they were first placed, and the slab used for covering them so as to keep them in an atmosphere even more confined then in the frame. The same figure shows the rooted plants pricked out into

boxes, which are sunk for about a week in the hot-bed where the plants rooted, and are then moved to a hardening-off frame on a less hot bed, where they are given more and more air. Here the plants have time to harden before they are planted out in the fields in April.

It is thus well established that herbaceous slips of cotton succeed well and grow quickly. In practice, it is necessary, for the current varieties, to transfer marked and carefully selected plants in December or January to the greenhouse, or forcing-frame ; they will soon make a profusion of buds from which herbaceous cuttings can be taken.

1415 – **Sugarcane Experiments at the Aligarh Experiment Farm.** SUGAR CROPS

PARR, A. E. in *The Agricultural Journal of India*, Vol. VII, Part III, pp. 301-304. Calcutta, July 1912.

In the United Provinces about 12 lakhs of acres of sugarcane are grown yearly ; of this total about ¼ is grown in the Meerut division and $^1/_5$ in the division of Rohilkhand. In the former almost the whole of the sugarcane is irrigated, while in the latter 40% is grown without irrigation.

The crop is sown in March or April, usually on land which has been lying fallow for several months. The " seed " is frequently put in a moist pit for several weeks before sowing. It is sown behind the country plough in furrows about a foot apart ; the land is then levelled and afterwards hand hoeings and irrigation are done when required.

Crushing begins about the middle of November and continues to within a short time of the next sowing season. Three-roller iron mills are used as a rule.

The canes grown in the United Provinces for sugar are usually very thin. Thicker canes are grown, but chiefly for chewing. In order to become acquainted with the merits of the canes of the province, variety experiments were begun at Aligarh three years ago. The soil on which the experiments have been conducted is clay and is liable to flood for several days in the rains. In 1909 several varieties of cane were collected from different parts of the United Provinces. The best ones were kept on, and

	First year		Second year	
	gur per acre	% *gur* to cane	*gur* per acre	% *gur* to cane
	lbs.			
Desi Saretha (grown from non-flowered cane)	8 763	11,31	8 327	12,56
Chin	5 349	10,49	6441	11,54

the collection was added to in 1910 and 1911, canes being obtained from other provinces.

Cane in this tract is chiefly grown for *gur*, and the yield of *gur* per acre has been the basis of comparison in the experiments. The juice was pressed out by an iron mill and then boiled in an iron pan.

Up to the present the *desi Saretha* variety has given much higher outturns than any of the others. *Chin* is the local Aligarh variety. The yields of these two varieties are given above.

The above are exceptionally high yields for the United Provinces. But local cultivators this year reported yields of 6500 to 7000 lbs. of *gur* per acre from *desi Saretha*. Many demands for this variety have now been received from the United Provinces as well as from Bengal.

Desi Saretha is a very tall, reddish cane, and is grown extensively in Muzaffarnagar district. It is peculiar in that it flowers very frequently; in fact, it has flowers every year at the Aligarh Farm. On this account many cultivators did not look upon it with favour at first, as they said that flowering results in much less *gur* being produced and also in general deterioration of the next year's crop if grown from flowered cane.

In experiments at Aligarh in 1910, it was found that flowered cane gave a slightly higher yield of *gur* than non-flowered, both per area of surface (10%) and relatively to the weight of the cane; the difference was, however, not enough to allow of a definite conclusion being drawn in favour of flowered cane. Only the best developed canes flowered, and selection of the flowered ones was merely another way of picking out the thickest and tallest canes.

In December 1910, March 1911 and January 1912 several comparative crushings of flowered and non-flowered *Saretha* canes were made. It was found that the *gur* from flowered canes was not inferior in quantity or quality to that from non-flowered, even in the case of canes that had flowered two months before crushing. This seems to indicate that in the case of *Saretha* no appreciable loss of *gur* results from the flowering of the canes.

In 1910 variety experiments were begun with canes suitable for chewing purposes. Some Mauritius canes proved much superior to the local varieties; they have given greater yields per acre, and up to the present have not been so liable to the attacks of white ants. In some cases the local chewing canes were destroyed by white ants, whilst Mauritius cane on neighbouring plots produced a good crop (1).

(1) Sugarcane setts are attacked by white ants in the interval between planting and active growth. Experiments were made to see whether a method inducing early growth would protect the setts against white ants. The sets were immersed for 6 to 12 hours in warm water. Those kept for 7 and 10 hours in water at 102° to 104° F. and then planted in non-irrigated

1416 – A New Vegetable Oil.

DE MELLO GÉRALDÈS, C. Note sur une nouvelle Huile végétale du Mozambique. — *Journal d'Agriculture Tropicale*, Year 12, No. 134, pp. 233-234. Paris, August 31, 1912.

The oil here dealt with is contained in the fruit of a plant from Mozambique, which appears to be a *Trachylobium*, (*Mossambicensis*, Klotzsch ?). It is a monospermous, drupaceous fruit, ovoid in form and chestnut yellow in colour when dry. The stone is also ovoid and greyish yellow, of a compact fibrous structure, very hard. The kernel, also ovoid, is white at first and afterwards yellowish on contact with the air. It measures about 21 mm. in length and 10 in width. In analysis it yielded the following results :

Moisture	3.418%
Fatty matter	46.021%
Albuminoids	28.930%
Starch	8.809%
Cellulose (by diff)	10 342%
Ash	2.480

This percentage of fat is nearly equal to the average of the oil palm. The pulp of the fruit too, which represents 41.2% of its weight, contains oil in the average proportion of 17.86%. Therefore the entire fruit contains an average of 12.48% of oil.

The oil of both the kernel and the pulp is of a golden yellow colour, brilliant, with a characteristic odour, and bad taste, very fluid at ordinary temperatures and half-drying.

On subjecting to analysis an oil of *Trachylobium* sp. extracted by pressure, in Mozambique, from the kernels alone, the following figures were obtained :

Physical constants :

Density at 15° C	0.920
Freezing point	— 4° C.
Index of refraction at 40° C.	1.46392
Degree by the butyro-refractometer	57°

Chemical constants:

Saponification value	188.87
Iodine value	77.13

Various:

Free acids (as oleic acid)	1.522%

soil, showed six weeks later a development about three weeks ahead of untreated ones. Others kept at 116° F. for half an hour and then at 110° for 6 hours were not killed, but germination was slow and irregular. (A. C. DOBBS, in *The Agricultural Journal of India*, Vol. VIII, Part III, pp. 308-310. Calcutta, July 1912). (*Ed.*).

From these constants and the characteristic of being half-drying, this oil may be classed in the same group as cotton seed oil.

From the commercial point of view it seems suitable for the manufacture of soaps, and according to Mr Joao Cruz, its price may be about 5d. per pound.

T. Mossambicensis, which some botanists regard as identical with *T. Hornemannianum* Hayne (1), is a tree of the family Leguminosae, 33 to 50 ft. high, which also supplies a good hard wood. It is more frequent in the extra-tropical region of Mozambique, but is also found in the tropical region. It is still indicated as the exclusive, or at least principal producer of the copal coming from East Africa.

The Author proposes to continue his studies of this new kind of oil.

RUBBER, GUM AND RESIN PLANTS

1417 – Hevea Rubber in Southern India.

ANSTEAD, RUDOLPH D., in *The Agricultural Journal of India*, Vol. VII, Part III, pp. 257-263. Calcutta, July 1912.

History, — The first rubber estate in South India was opened in 1902 at Thattakad, on the banks of the Periyar River in Travancore. This was followed in 1904 by estates in Mundakayam and South Travancore, and in 1905 by estates in Cochin, while since then many estates have been opened, in these districts and at the foot of the Wynaad and Nilgiri Hills, in the Nilambur Valley and its neighbourhood : here the first trial of Hevea had been made in 1879. This district has been described as the arena of part of a vast amphitheatre of mountains formed by the Velarimalay range on the north-west, the Wynaad Plateau (3000 ft.) on the north and north-east, and Nilgiris on the east and south-west.

The following table gives the area under Hevea in 1911 with the estimated yield of rubber for the chief rubber-growing districts of Southern India :

District	Area under Hevea in 1911	Estimated yield of rubber
—	—	—
	acres	lbs.
Malabar	7000	—
North Travancore	2231	150 000
Mundakayam	9652	159 000
South Travancore	6368 (and 1536 with Tea)	130 000
Cochin	3735	—
Shevaroys	1829	—

(1) The *Index Kewensis* indicates it as a distinct species, and *T. Hornemannianum* = *T. Gaertnerianum* Hayne. See Vol. II, page 1094. (*Ed.*).

Cultivation. — The trees are usually planted 20 feet × 10 feet; but when they are six or seven years old this is too close, and alternate trees have to be removed. Whether to plant wide at the beginning or to plant closely and thin out later is an open question; the latter is the cheaper way, as it reduces the cost of weeding and some rubber is obtained from alternate trees before they are removed.

Clean weeding is the general rule, and the constant scraping away of the top soil has in many places done much harm and held the trees back. In some places *Crotolaria* and *Erythrina* are grown as cover crops. The *Erythrina* is grown in rows between the rubber, and when it reaches a height of 3 or 4 feet, it is topped and the suckers are bent over so as to form a dense cover under which no weeds can grow. The suckers are cut two or three times a year and laid on the ground as a mulch. As the rubber grows up, the *Erythrina* gets weak and is then pulled up. On laterite soils deficient in humus this method is very beneficial. The leaves of *Erythrina* contain 1.4 % of nitrogen as they fall, and the sun-dried cuttings as much as 4.78 %. Manuring experiments are in progress, but no really reliable results have as yet been obtained.

Tapping. — The systems of tapping most generally adopted is the half herringbone, extending each time over ⅓ or ¼ of the tree. Other systems of tapping are under experiment, especially those in which the bark is not cut away but punctured with a tool called a "pricker," and also systems which are combinations of paring and pricking.

Manufacture. — To obtain a good class of rubber, the utmost cleanliness is essential in the handling of the latex. Two systems are employed for this according as young plantations with limited quantities of latex or plantations in full bearing are in question.

In the former case the rubber is made in the form of biscuits or sheets. As a coagulant acetic acid is generally used. The coagulated rubber is then washed, worked and dried in a hot room or an artificial dryer. The rubber finished biscuits are transparent and therefore popular on the market.

Where large quantities of latex are collected every day it is essential to have recourse to machinery. As a general rule this is driven by an oil-engine, but where great quantities of wood are available the use of a suction engine using water gas is cheaper. The customary method of manufacture comprises centrifugalling the latex (after adding acetic acid) until coagulation is complete; compressing between rollers; cutting up; drying in a hot air room; pasing through a crêping machine; cutting up into parts of the desired size; drying in chambers lit with red light only; and packing in standard boxes. The inside surface of the latter must be planed quite smooth so as to prevent the rubber being contaminated with dust or splinters.

Smoking. — Sometimes the rubber is smoked while drying. This is said to add to its strength, but the methods adopted can hardly be considered satsifactory. Much remains to be done by way of experiment on the point. The object is to imitate the Para rubber as made on the Amazon. This is coagulated in the smoke of a fire and made in blocks, the latex being laid on in successive layers, in which probably lies the secret of the success attained, and no process of smoking after coagulation can imitate this. The methods of coagulation by gas (carbon dioxide or others) have up to now not been tried in Southern India.

Conclusion. — "Wherever Hevea rubber is grown it presents many problems to be solved by both planter and scientist. No finality has been reached as regards even methods of preparation and here alone there is considerable scope for research work.

" In Southern India the rubber suffers from few diseases, and these are easily controllable, while the soil and climate are very suited to its rapid growth, seven-year-old trees attaining a girth of 23 inches and more at three feet from the gound. With regard to yield, nine-year-old trees have given 315 lbs. of rubber per acre, and seven-year-old trees 138 lbs. per acre.

Hence the industry should have a great future before it, if it is conducted on up-to-date and scientific lines. Unfortunately, however, there is at present little tendency towards progress, and there is practically no co-operation among rubber planters, and nothing is being done to provide for research work of a scientific nature being undertaken. The tendency is rather to wait for discoveries to be made in other rubber-growing countries and to follow rather than to lead."

1418 – Balata Collection and Preparation.

BOUCHER, VOLCY. Note sur la récolte et la préparation de la Balata à la Guyane Française. — *Bulletin de l'Office Colonial*, Year 5, No 55, pp. 209-213. Melun, July, 1912.

In French Guiana, balata trees abound and are well known to the native population ; they generally grow in groups containing usually some hundreds of individuals averaging 120 to 150 ft. apart. They are species of *Mimusops* which appear to grow indifferently in grassy plains and on hilly slopes or even in the mountains. Their latex when grown at a certain altitude, gets thicker and gives a larger yield than on the low-lying soils. The crop is got in as follows :

A gang in the charge of a foreman splits up into small groups of two, three or four men, and each group deals with the space of land assigned to it. Tapping is carried on exclusively by means of the herringbone cut. The centre channel traverses the entire length of the trunk (about 40 ft.) ; the length of the lateral incisions only reach on one side one-fourth of the circumference of the trunk, of which only half is tapped. If the whole were to be cut into, the tree would die, and their destruction is prohibited

by the Administration. The tree tapped must not be cut again until it has rested for about five years, and it then supplies nearly two-thirds of the latex yielded when it was "new". The latex flowing out is caught up in any vessel, and the quantities gathered by each workman are emptied by him into a waterproof bag. Each "balatist" must secure at least 3½ litres (over 6 pints) of latex per day, but good workmen are able to get up to 10 litres (2¼ gallons). The number of trees required for yielding 2 000 litres (440 gallons) of latex, which corresponds to a ton of trade balata, is reckoned at about 1 000. The day's yield, mixed if necessary with that of the two or three preceding days, is poured into a fermentation vat of a capacity of about 220 litres (48 gallons). After 30 days the dense froth formed during fermentation subsides and the surface of the latex becomes as level and smooth as a mirror. The latex is then distributed into a number of wooden basins (30×28×3½ in.) in which the layer of latex hardly forms a thickness of 2-3-4 in. These basins when full are exposed to the sun during the day and covered with an awning during the night. Every three days a slab of balata 1-6 to ¼ in. thick is removed; its reverse face is exposed to the sun, so that the lower side may dry, which takes about three days; afterwards it is stored away so that the drying may be completed during another four days in the shade. These balata slabs or sheets, about ¼in. thick, are kept stacked in piles.

1419 – Examination of Some Rubbers.

1. New Gutta-yielding Plants from the Gold Coast.
2. *Ficus elastica* Rubber from Southern Nigeria.
3. "Balata" Rubber (*Ficus Vogelii*) from Northern Nigeria.
4. The Rubber of *Cryptostegia grandiflora* — *Bulletin of the Imperial Institute*, Vol. X, No 2, pp. 205-212, London, July 1912
5. Rubber Investigation at Berlin — *India Rubber World*, Vol. XLVI, No. 4, pp. 475-476. New York, July 1, 1912.

1. — *New gutta-yielding plants from the Gold Coast.* Roots of a species of *Salacia* coming from the Gold Coast and previously examined in the Imperial Institute contained 8.5 per cent. of a substance resembling gutta-percha. Fresh material consisting of stems and roots of three plants called by the natives "Kplen", "Tetso" and "Akradekpa" or "Akradefi" yielded under analysis the following results:

	Roots		Stems	
	Crude gutta %	Pure gutta %	Crude gutta %	Pure gutta %
"Kplen" - *Salacia* sp.	13.10	11.35	4.47	2 10
"Tetso" - *Salacia* sp.	5.02	3.04	2.85	1 03
"Akradekpa" - *Hippocratea Welwitschii*	2.58	1.22	1.94	0.51

The first two species, which differ from each other, have edible fruits. The roots of the former alone contain gutta in sufficient quantity to be worth industrial extraction. The gutta appears to be of low value.

2. — *Ficus elastica rubber* originating from Southern Nigeria. Analysis of three specimens, respectively obtained by coagulation with carbonate of potash and drying in the smoke produced by burning the kernels of *Elaesis guineensis*; by simply drying in the above way; by drying over a fire of green wood. The third specimen was the best. Analytical results:

	No. 1 %	No. 2 %	No. 3 %
Loss in washing (moisture and impurities)	1.3	0 6	1.2
Composition of dry washed rubber:			
Caoutchouc	89.6	92.3	93.7
Resin	8.4	6.6	5.4
Protein	0.8	0.8	0.7
Ash	1.2	0.3	0 2
Value in London with fine hard Para at 4*s.* 1*d.* per lb.	3*s.* 4*d.*	3*s.* 4*d.* to 3*s.* 6*d.*	3*s.*

3. — "Balata" rubber (*Ficus Vogelii*) from Northern Nigeria. The sample examined was rather tenacious, but deficient in elasticity and slightly sticky; highly resinous. The caoutchouc isolated from it was almost black and its physical properties poor. Analysis gave the following results:

	Per cent.
Loss on washing (moisture and impurities)	26.0
Composition of dry washed rubber:	
Caoutchouc	49.2
Resin	47.7
Protein	2.4
Ash	0 7

The material was valued in Liverpool at 1*s.* 8*d.* per lb. It is generally supposed that the balata in Northern Nigeria is obtained from *Ficus Vogelii* and the above analytical results agree with those previsouly secured by the Imperial Institute from specimens derived from the foregoing species and coming from Gambia on the Gold Coast.

4. — The rubber of *Cryptostegia grandiflora*. Samples of this rubber were received from Gwalior State, India and from the Bahamas.

	Gwalior, India %	Bahamas: from vines 3 and 4 years old %	Bahamas: from vines 1 year old %
Loss on washing (moisture and impurities)	18.5	0 6	20.2
Composition of dry washed rubber:			
Caoutchouc	74.2	89.2	86.8
Resin	9.7	8.2	9.1
Protein	11.5	1.9	3.8
Ash	4.6	0.7	0.3

The Gwalior specimen was valued at 3*s.* 4*d.* to 3*s.* 6*d.* per lb. in London with fine hard Para at 4*s.* 8*d.*; the first Bahamas at 3*s.* 10*d.* to 4*s.* (Para at 4*s.* 4*d.*) ; the second Bahamas at 3*s.* (Para at 4*s.* 4*d.*). The three rubbers were all of good quality and agreed in composition with rubber from this plant from India previously examined at the Imperial Institute.

5. — Rubbers examined at Berlin. Results of analyses carried out by Dr. Fritz Frank in the laboratory of the "Kautschuk Zentralstelle für die Kolonien" in Berlin. There were examined 185 samples :— 77 of *Manihot*, 69 of *Kickxia*, 9 of *Castilloa*, 16 of *Ficus*, *Landolphia*, *etc.* and 14 of *Hevea*.

As regards the *Manihot* rubber, two samples recently sent from Togo were found of particularly good quality, which is attributed to the rational method of plantation. In several specimens sent from East Africa, which had been coagulated by chloride of calcium, it was not possible to remove this latter, but nevertheless the unfavourable effects attributed to it were not observed ; still caution is recommended in the use of this coagulation The washing of the rubber always proved harmful.

Among several sepcimens of *Kickxia* rubber sent from a plantation in West Africa those prepared with Purub showed marked appearances of decomposition. Consequently general methods of coagulation cannot be adopted, but a system must be used adapted to the soil conditions and to the salts which are thus contained in the latex. Coagulation with tannin yields an unattractive opaque rubber which does not sell well. The method of introducing carbonic acid and the blowing in of air is not suitable for the coagulation of the latex of *Kickxia* of for that of *Manihot*.

Among the other species particular praise is accorded to *Hevea*, which, cultivated in suitable and well-prepared soil, yields first-class rubber : the growing of *Castilloa* on the other hand is not recommended, because it is fastidious, but only yields third class rubber.

Among other points which have reached a technical solution, is the question of the extraction of rubber from the barks of trees, thus utilizing a sub-product. The bark of *Kickxia* yielded about 3.5 per cent. of wet rubber ; that of *Manihot* about 2 per cent. of rubber ; but only about half the quantity contained. The rubber thus prepared was of good quality and easily vulcanisable. On going into the problem as to whether the yield could be increased by treating fresh material, it was found that from the fresh leaves and wood, cut into pieces, of the guttapercha plant, relatively large quantities of gutta were extracted, while the dry material yielded little or none. Similar results were obtained with experiments on parts of guttapercha plants from New Guinea. These experiments will be continued.

The composition of the ashes of crude rubber is closely related to the quality of the latter. This composition depends directly on the soil of the

plantation. Lime and magnesia salts, as well as phosphates, exercise a different, but important, effect on the rubber. Experiments in this connection were entered upon in German East Africa by Dr. Marckwald and continued by Professor Zimmermann. The results will be set out in the next quarterly report of the "Zentralstelle." It was found that the absence of certain salts in the soil leads to the production of inferior quality of rubber. Investigations are being made as to how far manuring may remedy this defect. The apparatus used for measuring the viscosity of rubber has to a great extent been reconstructed. The viscosity gives valuable indications as to the quality of rubber and as to the durability of the articles which may be made from it; yet it does not give values of general application, but only of a comparative nature.

From the seeds of *Manihot* were obtained 8 per cent. from those of *Kickxia* 26 per cent. of oil; probably both are edible. The breaking of the hard *Manihot* fruit and the removal of the ligneous husk from the seed have been effected in a technically satisfactory manner. There remains to be solved the problem of extracting the bitter principle from the oil-cake in order to be able to use it as a feed.

The problem of obtaining first class quality rubber by the treatment of inferior qualities has been solved.

1420 – The Regeneration of Rubber.

BARY, PAUL La régénération du Caoutchouc — *Revue Générale de Chimie*, 14th Year, Vol. XV, No. 13, pp. 243-252 and No. 14, pp. 267-270 Paris, June 30 and July 14, 1912.

The problem of the regeneration of vulcanised rubber is regarded by some as being settled in a negative sense, the operation being, according to them, almost illusory. The experiments carried out by the writer lead to an absolutely opposite result, although he recognises that the industrial realisation of the methods yielding good results in the laboratory is as yet in its infancy. This study brings into prominence the fact that there is no theoretical reason in the way of the regeneration of rubber vulcanised with sulphur, and that this regeneration is practically realisable by anyone who will follow out one of the methods put forward by the writer. He begins by refuting the opinion according to which rubber is a live substance, pointing out that according to the works of Weber and Harries, natural rubber free from all impurities is known to be exclusively formed by a hydro-carbon, with formula $(C_{10} H_{16})\ n$ a polymer of polyprene. The study of this formula and the chemical reactions leads to the assumption that the polymerisation of rubber is a true and genuine combination of the rubber with itself, and that the formula $(C_{10} H_{16})\ n$ of a rubber, just as happens with all other colloids, must be regarded as an aggregate formula in which n has only a mean statistic value and in which

the molecules having this same exponent *n* might likewise have a non-identical constitution.

Vulcanisation therefore must be regarded as an operation which results in a combination of a part of the sulphur used with the rubber. The experiment tends necessarily to compel acceptance of the hypothesis that all the molecules present in the vulcanised rubber have as many atoms of sulphur as there are double bonds between them, and that vulcanised rubber, save for the tanning substances mixed or absorbed in it, is exclusively made up of a series of sulphides and of free sulphur.

A more and more thorough sulphuration, which is necessary for more complete vulcanisation, must necessarily lead to the splitting up of the polymerised molecules and the breaking of the double bonds which the sulphur must saturate. That is why vulcanisation is accompanied by a depolymerisation of the rubber molecule and each operation which favours this depolymerisation facilitates its vulcanisation. The problem of regeneration is considered by the writer from a special point of view. It is not a question of reproducing a body capable of taking the place of natural rubber in its uses, *but the rubber extracted from the refuse of vulcanised rubber sufficiently freed from foreign substances and brought back to a condition which will allow of its taking the place of natural rubber in mixtures, must be regarded as regenerated.*

In order to obtain this regenerated substance it is therefore evident that first of all the rubber must be devulcanised and that the vulcanisation having been made after depolymerisation, the resulting product will be a depolymerised rubber. It must however be remembered that a rubber left to itself at a sufficiently low temperature, sheltered from the light, for a sufficient time, polymerises.

The theoretical bases of the regeneration of rubber are therefore perfectly sound. All this tends to show that vulcanisation must be regarded as a reversible reaction and the sulphuration of rubber as a reaction of equilibrium in which the conditions of temperature and pressure determine the quantity of sulphur, polyprene and free sulphur simultaneously present. In the same way as we compel vulcanisation when the excess quantity of sulphur is higher than that corresponding to the equilibrium, we may easily proceed in devulcanisation, reducing the quantity of free sulphur and thus setting free for the needs of this same equilibrium a part of the original sulphur combined with the rubber. The experiments of the writer leave no doubt on the point ; below we give by way of example one of these experiments :

Some vulcanised rubber is taken and is exhausted with acetone in order to remove the free sulphur as far as possible. The remaining rubber is heated in an oven to 145° C. for 8 hours. Then a fresh extraction of the sulphur is made with acetone, after which the sulphur is again re-

turned to the stove, and so on. At each new operation, the sulphur, which had completely combined, becomes free in the proportion of 8.5 per cent.

Technical rubber specialists know that the presence of certain catalysers renders vulcanisation more rapid ; the same substances likewise accelerate devulcanisation.

The successive operations of regeneration by the method of solution are as follows :

1. Pulverisation of the rubber scrap and refuse.
2. Dissolution in a suitable solvent.
3. Removal of the rubber set free after dissociation of the polyprene sulphur.
4. Separation of the indissolved substances, mineral or other.
5. Separation of the non-colloidal dissolved substances.
6. Extraction of the rubber from the solution.

The pulverisation of the waste presents no difficulty, and the cost of this operation is very low. For the selection of the solvent the number of products proposed is considerable. The writer gives a fairly complete list of patents taken out for different hot solvents of vulcanised rubber. A thorough study must be made in respect of the solvent to be chosen according to the method intended to be adopted, with the object of recovering the solvent afterwards with the least possible loss.

In order to fix the freed sulphur in proportion as it forms, a number of substances have been proposed which the writer enumerates, publishing the list of the different patents. In this list, much shorter than that of the solvents, three groups may be distinguished :

1. Soda, lime, baryta ; alkaline carbonates and sulphides, and soaps.
2. Aniline and its homologues.
3. Metals, oxides and metallic salts.

In addition to these chemical methods, the sulphur may also be removed from the rubber solution by osmosis. This is the cheapest method and likewise the best, because the rubber is not subjected to a chemical action which may be injurious.

By settling and by osmosis the 4th. and the 5th. operations provided in the above cycle are carried out, and finally the separation of the rubber from the pure solution is made by coagulation or by conveying the solution into an apparatus where the solvent is drawn away by a current of steam.

An account prepared by the Author in order to find out what was the cost of the solvent during a complete treatment, and based on the hypothesis that xylol is used, yielded the exceedingly low figure of 1 penny per pound of regenerated rubber produced.

1421 – Synthetic Rubber.

1. DUBOSC, A.: Les matières premières du caoutchouc synthétique. — *Le Caoutchouc et la Guttapercha*, 9th. Year, No. 192, pp. 6453-6458. Paris, August 15, 1912.

2. DITMAR, R.: Les produits pour la production du caoutchouc synthétique. *Ibidem*, pp. 6458-6462.

3. MAIN, F.: Le Caoutchouc de synthèse — *Journal d'Agriculture Tropicale*, 12th. Year, No. 133, pp. 196-199. Paris, July 31, 1912.

4. PERKIN, W. H.: The Production and Polymerisation of Butadiene, Isoprene and their Homologues — *Journal of the Society of Chemical Industry*, Vol. XXXI, No. 13, pp. 616-624. London, July 15, 1912.

5. HARRIES, L.: Sur les Hydrocarbures de la série du butadiène et quelques sortes de caoutchoucs artificiels qui en dérivent. — *Moniteur Scientifique Quesneville*, 56th. Year, Part 845, pp. 289-311. Paris, May 1912.

6. KONDAKOFF, J.: Le Caoutchouc synthétique, ses homologues et ses analogues — *Revue générale de Chimie pure et appliquée*, 14th. Year, Vol. XV, No. 8, pp. 129-143. Paris, April 21, 1912.

CAYLA, V.: Caoutchouc artificiel et Caoutchouc naturel — *Journal d'Agriculture Tropicale*, 11th. Year, No. 121, pp. 198-202. Paris, July 31, 1912.

The problem of the synthetic production of rubber will now be one of practical importance, thanks to the ceaseless investigations of men of science, who have solved the scientific difficulties, and are now engaged upon the practical and industrial side of the question. Synthetic rubber is a purely chemical product, which is very similar to, if not identical with, natural rubber, and is capable of replacing the latter in industrial uses. It should be considered primarily as a product of the polymerisation of isoprene, a hydrocarbon which was isolated for the first time by Greville Williams in 1860 by distillation from rubber itself. It was only in 1884 that Tilden discovered another method of preparing isoprene, by pyrogenic decomposition of turpentine, while in 1888 Kondakoff obtained synthetic isoprene for the first time by treating trimethylethylene chloride with alcoholic potash at 150, 160 and 170° C. From 150 gr. of the chloride he obtained by decomposition 10 gr. of hydrocarbon with a boiling point of 33° to 35° C.

Isoprene was, at that time, of great technical importance owing to its property of dissolving rubber, and the distillation of rubber as well as the production of isoprene by pyrogenic decomposition of turpentine rendered great services to industry, until other and more economical solvents were discovered.

But, the synthetic production of isoprene greatly increased its importance in the study of the possibility of the artificial manufacture of rubber. Experts turned their attention to the structure and properties of isoprene and to the terpenic carbides obtained by the distillation of caoutchouc and the polymerisation of isoprene.

Already in 1875, Bouchardat, in treating isoprene with a saturated solution of hydrochloric, hydriodic, or hydrobromic acid, had obtained a polymer identical in its qualities with natural caoutchouc ; the communi-

cations which he made to the "Académie des Sciences" of Paris from 1875 to 1879 show the importance of the discoveries which he made in this field of research. Tilden, on repeating the experiments with the isoprene which he obtained from turpentine, obtained in 1882 identical results and affirmed the possiblity of the commercial manufacture of rubber; but his experiments had no immediate results and in the mean rime the study of natural rubber on the one hand, and the observations of Wallach, Tilden, Weber, Kondakoff and Makievsky on the spontaneous polymerisation of isoprene and its homologues on the other, brought the study of the important problem to the point where it was in 1900, that is to say a considerable acquaintance had been made with natural rubber, though its true nature was still undetermined. Further, it had been proved that, by the polymerisation of isoprene, a product was obtained, which, though it had not been sufficiently investigated, was found like natural rubber, to combine with sulphur, to change on contact with oxygen and to decompose with heat, giving the same decomposition products as the latter.

From 1900 to the present day, more important investigations have been conducted, which have brought the solution of the problem much nearer.

In 1900, Kondakoff published his researches on the polymerisation of the homologue next higher than isoprene, methylisoprene, a spontaneous result brought about by chemical action and also by the action of light.

This amorphous and elastic product differs from true caoutchouc, or polyprene, of which it is a homologue, in the fact that it is insoluble in liquid hydrocarbons.

Harries, one of the chemists who has contributed most to rubber synthesis, also obtained a methylisoprene, which only differed from that of Kondakoff in being a pentadiene instead of a dimethylbutadiene.

Since this time, patents for the synthetic production of rubber have been continually increasing, but the problem can only have been considered solved from 1907.

Perkin, Matthews, Harries, the chemists of the "Badische Anilin und Soda Fabrik," those of Bayer, men of science and manufacturers, worked on the same lines, and at the close of 1910, the polymerisation of isoprene by means of sodium was made simultaneously by Harries and Matthews.

Prof. Hofman of the "Elberfelden Farbenfabriken," and the "Badische Anilin und Soda Fabrik" also base their processes on the polymerisation of isoprene. The production of the latter substance is of great importance to the industrial practice of the different processes, seeing that all the patents which have so far been taken out everywhere, are based on its polymerisation.

A group of 14 scientific men, chemists and bacteriologists, having Matthews at their head and Perkin and Ramsay as advisers, and including Strange and Fernbach, are studying more minutely the means of obtaining isoprene economically.

These investigations show how much the industrial manufacture of synthetic rubber affects agriculture. Fot it is certain that this discovery will strike a blow to the market of the natural rubber produced by the celebrated forests of America and by those recently discovered in Africa, as well as to the products of the plantations and cultivations, which have been so successfully started, both in the Malay Peninsula, and in Africa itself. But on the other hand it appears that isoprene must be obtained from other agricultural products.

The problem of synthetising isoprene is certainly solved, but at present it is too costly to put into practice. The chemical reactions based on the studies of Ciamician, Spatieff, Euler and Kondakoff are not easily carried out so as to give a high quantitive result; while, on the other hand, the relative costliness of the reagents used precludes the production by this means of rubber, which is at present obtained from the plantations. at a cost price varying from 1s. to 1s. 8*d*. per lb.

Agriculture is thus in a good position as regards the supplying of the necessary isoprene, and already many natural products could serve to furnish the first substance necessary for its economical production. Harries and Gottlob obtained a considerable amount by passing turpentine vapours over platinum wires electrically heated. But oil of turpentine is not a cheap product, and if it were employed in this way, it would end in becoming too expensive to supply the urgent demands of the world for rubber.

The uses to which rubber is put increase daily; in 1911, the production was estimated at about 70 000 tons and the increase of consumption has been reckoned at 5, to 15 or 20 % annually. It is anticipated that in 1916. counting the important contribution from the Malay Peninsula, at least 160 000 tons of rubber will be on the market. Thus, a synthetic product, which would be costly owing to the scarcity of the principal substance from which it is made could have no real industrial success.

The matter would, however, be otherwise, if the patents of Fernbach and Perkin were adopted and the investigations of Effront turned to account. (1) The latter obtained by means of bacteria a great production of fatty acids in the waste water from distilleries. He used for this purpose amylase, an enzyme which is found in all yeasts when used in brewing bread-making or distilling. Its chief function is the transformation into

(1) See No. 2887, *B.* Aug.-Sept.-Oct. 1911 (*Ed.*).

ammonia of the nitrogen of the waste waters, with the liberation of the fatty acids derived from the acid amides.

Butadiene is easily and cheaply obtained from these fatty acids, and as has been seen it is one of the fundamental hydrocarbons of rubber. In the same manner, starch by means of the fermentation systems discovered by Fernbach, can be made to furnish fatty acids from which acetone, pinacone and finally, dimethylbutadiene can successively be derived by easy, cheap and productive means.

The group of scientific men mentioned above believe in the possibility of a practical solution of the problem in this manner by using the inexhaustible supply of starch, or sugar, which is already furnished to industries by cereals, tubers and roots. Further, the distillation of potatoes affords in fusel-oil an important substance rich in *iso*-amyl alcohol; from this isoprene can quickly and economically be obtained.

Finally, other sources of isoprene are alcohol, acetone produced by wood distillation, the acetic acid derived from acetylene, adipic acid from the residuum of petroleum, benzol, etc.

As is seen, alcohol, fusel-oil, starch, sugar and waste water from distilleries are all products which agricultural industry can supply at a low rate, and which could thus be turned to good account in this new and very important industry. These substances can, moreover, be produced in those very districts where the effects of the new situation will most be felt and thus they will be offered the chance of producing cheap isoprene.

In fact, Australia is already putting on the market an acroid resin from a tree of the genus *Xanthorrhœa* called the "grass-tree," which grows wild in the forests of Tasmania and Kangaroo Island. This resin gives by distillation a really cheap isoprene. Even if the yield is not large it must be realized that this resin, which is at present imported into Germany for making paints and smokeless powder, fetches in Europe about ½*d* a pound; is that in the case of a substance like rubber, the margin is large, and would allow of much handling before reaching the present or even the future price of rubber.

This brief review of the question can be summarized as follows: the problem of rubber synthesis is gradually approaching nearer to a practical and industrial solution, while at the same time, on account of the continually increasing consumption, the natural product will probably hold the field for a long time; for although other branches of agricultural industry will develop greatly in supplying the new demand for the first principles of the synthetic product, the cost price of natural rubber will decrease with its cultivation and improved technique.

1422 – Coffee-Growing in the Province of Mananjary, Madagascar.

ROLLOT. Rapport sur la culture du Caféier dans la province de Mananjary. — *Colonies de Madagascar et Dépendances. Bulletin économique publié semestriellement par les soins du Gouvernement général*, 12th. Year, No. 1, pp. 1-12. Tananarive, 1st. Half-year 1912.

Coffee-growing has attained great importance in Madagascar, especially in the valley of the Mananjary, which possesses about 600 000 coffee plants (522 000 of *Coffea liberica* and 72 000 of *C. canephora*) and planting is still being continued. Liberian coffee (*C. liberica*) was introduced into Madagascar about 40 years ago, but only from 1900 to 1902 was planting work begun on a large scale; this work was taken up again briskly from 1905 onwards, *i. e.* at the time when the good results from the first plantations which were then in bearing, became manifest. *C. canephora* was introduced by a planter in 1900.

Only a small proportion of the coffee plants have at the present time begun to bear fruit; consequently the exportation of coffee from Mananjary in 1910 was barely 92 tons; in a few years' time, however, it will amount to at least 400 tons.

The best soils for coffee are rich alluvial soils; these however are scarce in Madagascar. Good results are also frequently obtained on hilly mounds and knolls. The trees, growing less, can be planted more thickly at distances of 10 to 11 feet apart instead of at least 12½ ft. Well-characterised laterite, rich in iron of a dark red colour, is much better suited to the Liberia coffee than low lands in which only the superficial stratum is rich in humus and the subsoil is clayey and yellow.

Light wind-breaks are generally employed. Good production is secured both from coffee plants exposed to the sunlight and others kept in the shade; in alluvial soils shade is unnecessary; on knoll-like elevations it is more useful. Almost all planters shelter the coffee by plantations of *Albizzia Lebbek* (black wood). The writer thinks that a light shade cannot be otherwise than useful, especially during dry periods and in low-lying grounds. The kapok is well adapted as a shade plant; the writer also advises the use of *Albizzia stipulata*.

Trimming to 5 or 6 ft. is almost a general practice. The "Compagnie Lyonnaise," which possesses 123 000 Liberia coffee plants and 17 000 *canephora* plants on hill land, has not resorted to it; nevertheless, these plantations are exceedingly fine. Sucker branches are cut out; from 3 to 7 hoeings are carried out per year, requiring from 6 to 7 workmen's days per acre, paid at the rate of 6 *d.* (or to be more exact, a workman is provided with rice and 10*s.* per month). Ploughing shortly after planting would be useful, but in most cases is omitted because too expensive. Superficial ploughing does not seem to injure the coffee trees.

To provide dung, almost all planters carry on breeding also. A fodder which is found to thrive on the hillocks after ploughing is *Panicum molle*.

A few trials have been made of chemical manures ; it would seem that phosphates and potash are more necessary than nitrogen.

Picking continues throughout the year, but principally from the end of September to the end of March, and attains its maximum in the months of November and December. For picking from the higher branches very light steps or ladders are used, made from the stalks of rafia leaves. The work is paid at the rate of 2*d.* per measure of 66 to 88 lbs. of beans. The Liberia coffee tree bears fruit in the 4th. year; in the 5th. the crop hardly pays the year's expenses ; in the 6th. year from 5 to 7 oz. are secured ; in the 7th. year from 11 to 18 oz.; in the 8th. year from 25 to 28 oz.; in the 9th. year 2¼ lbs.; from the 10th. year onwards at least as much, and on good and well-kept land 3½ lbs. or with manuring even 4 ½ lbs. per tree.

The removal of the pulp from the fresh beans is preferred to the husking of the dried beans. Machines are in general use. The plant for the preparation of coffee comprises :

A tank supplying the necessary water ; one or more bean sorters, pulpers, fermentation tanks, washing tanks, drying floors, huskers (which remove the parchment-like skin) and storage places. The machines most in use are those of the firm of Gordon. The Gordon pulper mostly used pulps from 2 to 3 tons of beans per day by the aid of 4 to 6 men. The Billioni machine can treat 2 tons to 2 tons 4 cwt. per day with the same staff ; the Simon crusher can crush 10 tons of beans per day with one man ; two men are required to carry out the sorting. The Gordon husker can in one day husk 5 tons of coffee in the skin producing 7½ cwt. of clean coffee with 4 men. The coffee is packed in reed sacks of local manufacture, selling at 6*s.* 8*d.* to 8*s.* per 100. Double packing is employed. Each sack contains 48½ lbs. of coffee ; packing, including labour, costs 5*d.* per cwt.

In 1910 Mananjary coffee sold in France at 7½*d.* to 8½*d.* per lb. in bond. At the beginning of 1911 prices were between 8½*d.* and 10*d.* per lb. for Liberia coffee and at 11*d.* for " kouillou " (*C. canephora*).

The cost of one coffee tree which has come to bearing is estimated at 1*s.* to 1*s.* 5*d.*; the preparation of the soil costs £1 to £1 15*s.* per acre; digging the hole in soft earth ½*d.* and on the knolls from 1*d.* to 1¼*d.* From the 5th year onwards one labourer suffices for 1 000 trees — according to others 2 000. Picking costs ¼*d.* per lb. of coffee ; preparation and packing ¼*d.* at most ; the costs of transport to the place of shipment, conveyance, insurance, commission, etc., are estimated at 17*s.* 6*d.* per ton. On the basis of these figures the following approximate coffee growing account can be drawn up for a plantation of 30 000 plants, such as is found in several instances in Mananjary.

Expenses of planting and upkeep to 5th. year at about 1s. 2d per plant	£1 750
Building a dwellinghouse, open sheds and drying floors and purchase of machinery	£600
Maintenance of planter for 6 years at £150 per year	£900
Total	£3 250

In the 5th. year the crop pays expenses; from the 6th to the 8th. the profit is very small and easily calculated on the basis of 1 3/4 *d.* cost of upkeep for each coffee plant and a production of 9 oz. in the 6th. year, 14 oz. in the 7th. year, 25 oz. in the 8th. year. In the 9th. year the coffee tree yields 2 lbs. 3 oz. of coffee. The expenses are:

Upkeep of 30 000 coffee plants	£215
Gathering of 30 tons of berries	£80
Preparation and packing	£60
Conveyance to place of shipment, insurance, transport, etc, at £8 15s per ton	£262
Redemption of capital	£162
Total expenses	£779

To these expenses must be added those for manuring at the rate of 1*d.* to 1½*d.* per tree.

Receipts.

Sale of 30 tons of coffee	£2 150

This account refers to an estate under the management of the owner. Consequently there might be added to the expenses the salary of a European employé and several gang foremen. On the other hand, the production of 2 lbs. 3 oz. per plant in the 9th. year is fairly conservative, as average productions of 3 lbs. 5oz. per tree in plantations are by no means rare.

Labour is supplied almost entirely by the natives of the region.

The Liberian coffee tree possesses great powers of resistance to diseases. Here and there in the plantations areas are found in which the trees have yellow leaves and are of slow growth, but it remains to be determined whether this is due to disease or, as the writer thinks, to the unfavourable influence of the subsoil. *C. canephora* up to now presents the same resistance to disease; it remains to be seen whether it will not decline in consequence of cultivation.

C. canephora (kouillou) is beginning to take an important place in the plantations. Of a lesser growth than Liberia coffee, it can be planted more densely and trimmed to 5 or 6 ft. without reducing its production;

it is more resistant to *Hemileia* and produces from the 3rd. year onwards. The fruits ripening simultaneously, only require a single gathering. The yield is one-fifth of the fresh product as against only one-tenth from Liberia coffee ; furthermore the preparation offers greater facility and the article is disposed of more easily and at a better price (8*s*. to 12*s*. per cwt. more than Liberian). It however requires fertile soil and shade (preferably light, according to the author), produces less and does not, like the Liberian, allow of delay in picking until the time most suitable for labour. Moreover, while the Liberian tree is a well-known species, *C. canephora* is less well-known, for which reason it would be imprudent to make exclusive plantations of the latter. At the present time many are engaged in planting Liberian coffee and *C. canephora* in alternate rows, intending to do away with whichever kind proves less advantageous. Mixed cultivation of the two species presents the advantage that the same labour can be employed for the crop and preparation of both, since *C. canephora* ripens during the pause in the ripening process of the Liberia.

1423 – The World's Tea Trade.

The Indian Agriculturist, Vol. XXXVII, No 7, pp. 222-223 Calcutta, July 1, 1912.

The following is from the *Financial Times*.

The production of tea in the 1911 season was estimated at 700 million pounds. It is very difficult to ascertain accurately the production of India ; thus, while official statistics for 1910 indicated a production of 261 681 000 lbs., Messrs. Thomas & Co. of Calcutta showed that in the season 1910-11 (when the 1910 crop was handled), 267 396 000 lbs. were exported or delivered for local use.

The Indian Director-General of Commercial Intelligence points out, in submitting the statistics, that the figures recorded cannot be strictly accurate. This reservation is likewise made in respect to those here reproduced. They refer to periods of 12 months, some terminating on Decenber 31st., 1911, and others March 31st., 1912.

Estimated Supply Provided.

	Lbs.
India	272 000 000
Ceylon	187 700 000
Java	50 400 000
Japan	42 800 000
Formosa	25 700 000
China	118 400 000
Natal, Annam, etc.	3 000 000
Total	700 000 000

In this computation no account is taken of the brick tea turned out from the factories in China, as its quantity is not known and it does not enter the English markets in competition with imported tea ; before 1911 the average annual output of such tea was about 80 million pounds. What is produced in China and Japan for home consumption is likewise left out of account. Assuming 5 lbs. per head per annum and a population of 342 million inhabitants, we arrive at a consumption of about 1710 million lbs. Nevertheless, large tea plantations are practically unknown in that country.; in the eight chief tea provinces it is grown in small patches round the homesteads.

The large home consumption explains why the quantity exported is limited ; on the other hand, Chinese exportation may possibly increase in response to alluring prices. The quantity used in Japan is estimated as being much less than that exported and the production as insufficient to allow of a greater exportation.

The annual consumption of tea in most of the countries consuming that article may be approximately estimated as follows :

	Lbs.
United Kingdom	296 000 000
Australasia	40 000 000
South Africa	4 000 000
North America	138 000 000
Russia	110 000 000
Rest of Europe (excluding Turkey)	35 000 000
Morocco, Algeria & Tunis	7 500 000
Persia	8 000 000
Argentina and Chili	7 000 000
India (including imports)	15 500 000
China and Korea (imported) . .	16 000 000
Total	680 000 000

To this total must be added the great quantity of, tea dust which is, in England and abroad, denatured and employed for the extraction of caffeine. It may be estimated as probably in excess of, and certainly not less than, 6 000 000 lbs.

The consumption of countries not included in the above list is valued at about 14 000 000 lbs.

On the whole it may be stated that the use of tea is undergoing slow but continuous increase, so that production and consumption have remained well balanced and there can be no question of over-production of tea.

1424 – Variation in the Nicotine-Content of the Organs of the Tobacco Plant during Growth.

CHUARD, E. and MELLET, R. Variations de la proportion de nicotine dans les divers organes de la plante de tabac au cours de la végétation. — *Comptes Rendus des Séances de l'Académie des Sciences*, Vol. 155, No. 4, pp. 293-295. Paris, July 22, 1912.

The great importance acquired during the last few years by nicotine as an insecticide has opened up the possibility of tobacco-growing with the object of the production of this alkaloid (1), which is still as yet the secondary product of the industry. The investigations of T. H. Schloesing, Jun., in 1910 concluded this question in a negative sense, because the price fetched by nicotine in France at that time did not admit of cultivating tobacco for this purpose alone. Nevertheless the authors thought it would be interesting to see what actual quantity of nicotine existed in the principal organs of the plant when fresh, because they noted that during the curing of the leaves a substantial quantity of nicotine, sometimes more than 30 %, is lost. They proposed likewise to ascertain the proportions of nicotine in the by-products or residual products of cultivation when fresh.

The tobacco grown was a variety of *Nicotiana virginica* and was treated on the Swiss method (seed bed, transplantation, weeding, topping, pruning and gathering the leaves). The sowing was effected on the 25th of April 1911 and the Authors were already able to examine a group of seedlings selected before transplantation on the 15th of May. The plants subjected as a whole to analysis then only contained traces of nicotine ; one month later, however, on the 16th of June, the young transplanted plants contained the following quantities of nicotine per 100 parts of dry substance : leaves 0.35, roots 0.15. The following were the results obtained on the 14th of July just before topping, on the 9th of August at the removal of the side-branches , on the 18th of September during the gathering of the large leaves and on the 4th of November after the first frosts.

Date of taking samples	Per 100 of dry matter.				
	Leaves	Stalks	Roots	Side shoots	Tops
July 14	0.34	0 08	0 45	—	0 49
August 9	3 12	0 61	0 69	1.04	—
September 18 . . .	4.79	0 52	0 63	1.27	—
November 4	—	0 47	0.53	1.04	—

Independently of the conclusions which may be drawn from a scientific point of view, it is interesting to observe that after the gathering of

(1) For experiments on this subject in England, see No. 1903, *B.* July 1911. (*Ed.*).

the leaves the remaining parts of the plant, stalk, top, side shoots and roots, on the method of cultivation and gathering practised in Switzerland, Alsace, the Palatinate etc., can be gathered and treated in the green state, because they contain by no means negligible quantities of alkaloids; a system which would allow of economic extraction of the latter, leaving residues utilisable as manure, would be worthy of study in the regions to which the above data refer.

1425 - **Quebracho Trees** (1).

Los Quebrachos. — *Gaceta Rural*, Year VI, No. 61, pp. 45-47. Buenos Aires, August 1912.

Red Quebracho. — The importance of this tree (*Schinopsis Lorentzii*) undergoes continual increase in proportion as the number of its applications is enlarged. At the present time its wood, which is very rich in tannin, is used for tanning, for building purposes generally and especially to furnish excellent sleepers for railways.

The Argentine Railway Companies, which heve already put down more than ten million sleepers, are as yet unable to pronounce judgment as to the duration of this material because some in use for more than 30 years are still in perfect condition. The "Central Argentino" Company estimates their duration at 50 years, beyond which they are unserviceable, not in consequence of the quality of the wood, but owing to the repeated change of the nails, which in the course of time makes them useless.

The following are the results of some strength tests carried out on the red quebracho of the Chaco, which is deemed the best, and on oak.

	Quebracho	Oak
Density	1.232-1.392	0.643-1.015
Coefficient of elasticity (lbs. per sq. in.)	2 101 000	1 700 000
Breaking load (lbs. per sq. in.)		
tension	16 983	14 209
compression	17 320	7 100
bending	21 910	10 650

White Quebracho. — This is *Aspidosperma Quebracho*, very important owing to its widespread character and its applications in carpenter's work and building work generally, as a fuel, etc.

The strength tests on specimens coming from the Chaco yielded the following results :

Water %	4.80
Density	0.912

(1) See No. 173, *B.* Jan. 1911. (*Ed.*).

Breaking load (lbs per sq. in.)	
tension along the grain	7 170
compression " "	7 370
compression crosswise of the grain	7 610
shearing stress along the grain	2 513
shearing stress crosswise of the grain	5 027
Bending (lbs per sq. in.)	
max tension of the fibre, limit of elasticity	6 120
max tension of the fibre, breaking moment	11 530
modulus of elasticity	948 500

The coefficients of the loads admissible in practice according to the different kinds of strength are as follows :

tension along the grain (lbs per sq. in.)	850
compression " " " "	700
bending " " " "	570-850

1426 – The Tonka Bean.

GRISARD, J. Le Févier tonka. — *Journal d'Agriculture Tropicale*, Year 12, No. 133, pp. 193-196. Paris, July 31, 1912.

Dipteryx odorata, Wild., which yields the tonka bean, is a large and fine forest tree attaining a height of 65 to 80 feet, and belonging to the family Leguminosæ. According to Dr. Creveaux each tree yields about 26 lbs. of beans and the fruit is gathered every other year. The crop is secured by shaking the ripe fruits to the ground and drying them until the pulp is completely dry ; not till then are the shells opened and the beans taken out, the latter being dried in the shade and then put into a recipient containing alcohol at 65 %, where they are soaked for half a day. The alcohol is let out of the vessel and the beans left dry for five or six days, wrapped up in a cloth. After the expiry of this first period they are laid to dry in the shade. In Venezuela, before being put on the market the beans are soaked in rum and then once more dried. Almost the whole of the Tonka beans put on the market come from Venezuela, which exports them under the name of " Serrapia ", the principle market being Ciudad Bolivar. The quality fetching the highest price, however, is the Venezuela quality known as " Angostura." Roure Bertrand estimates the last crop at about 25 000 lbs., worth 19s. per lb.

Few data are available regarding the best conditions and the tending needed for a good cultivation of this important drug, as *Dipteryx* is generally not cultivated. The only plantation of *Dipteryx* is at Borburata ; it is the first of its kind and from it alone, by recording its vicissitudes shall we be able to gather such information as will enable cultivation to be undertaken. According to the present proprietors it seems that

Dipteryx succeeds well in dry places and on hills, under the same conditions as cocoa, with which it is intermingled as a shade-plant. Nothing has as yet come to light with regard to the age at which fruiting begins, its length of life and the productivity of each individual.

1427 – **The Essential Oil of the "Nepal Sassafras" or "Nepal Camphor" Tree.**

PICKLES, SAMUEL SHROWDER in *Journal of the Chemical Society*, No. DXCVII, Vols CI & CII, pp. 1433-1443. London, 1912.

The author refers to *Cinnamomum glanduliferum* Meissn., known as "Nepal Camphor wood" or "Nepal Sassafras." which is a large tree occurring in the Southern Himalaya from Kumaon eastwards to Assam, especially in Nepal.

Its wood is pale brown, easily worked, and not attacked by insects. It is used in Assam for boat-building and for making boxes. When freshly cut, the wood is highly scented, and its odour has been described as camphoraceous; up to now no study of the nature of the volatile constituents of the sassafras wood has been made.

The odorous substance can be extracted from the wood and the leaves, but investigations as to the yield of volatile oil have only been made for the former.

The extraction of the oil was carried out by subjecting the heartwood or duramen to distillation after grinding it up. The yield was 2.95 per cent. of the weight of the original wood or 4.16 per cent. of the wood after grinding, which entails considerable loss of moisture. The essential oil thus obtained is clear, of a pale yellow colour, with a density of 1.1033 at 15°; it is soluble in half its volume of 90 per cent. alcohol and in five volumes or more of 80 per cent alcohol.

It is found to consist in the main of safrole, miristicin and elemicin.

1428 – **Early Tomatoes at Hawkesbury Agricultural College.** MARKET GARDENING

ALFORD, JAMES, in *The Agricultural Gazette of New South Wales*, Vol. XXIII, Part 7 pp 605-609 Sydney, July 1912.

According to the writer, few crops are as paying as early tomatoes to any one possessing a small plot of sandy well-watered soil, if the latter is given a sufficient amount of farmyard manure. He gives in proof of this statement the results obtained at the Hawkesbury Agricultural College, where one third of an acre produced £130 worth of fruit.

The variety planted was "Sparks Earliana," which is admirably adapted for trellising and pruning. To sow half an acre 2 ounces of seed is sufficient. The seed is sown about the middle of July in seed boxes about 10 in. deep, and 3 inches of rotten manure or similar material are placed at the bottom for drainage purposes; these are followed by 3 inches

of nice, free sandy soil. The boxes are covered with sheets of glass to exclude the cold air and these are gradually tillted back as the plants come up, in order to give them ventilation, being finally removed altogether. The boxes are plunged into the hot-bed. When the seedlings are about 2 in. high, they are pricked into 3 in. pots, which are placed in the hot-bed ; they must be protected at night from frost. About the third week in September, the plants are set out in the field ; if the weather looks threatening after that, a ti-tree bush is placed to protect each plant.

The tomatoes are grown on trellises 4 ft. or 4 ft. 6 in. apart and are placed 15 in. apart in the rows. Pruning is the most important operation in the whole process ; when it is carefully done, the tomatoes can be made to ripen a month earlier. It consists in pruning to one main stem, and taking care not to injure the leaves or flowers. When the main stem reaches the top of the lath (about 5 ft.) it may be pinched off. This pruning should be practised regularly about once a week. The tomatoes, whether in the seed-box, hot-bed or the field, must be regularly watered, and the soil kept always moist. If there is danger of night frosts, it is best to water the seedlings in the morning.

Occasionally the tomatoes may be sprayed with Bordeaux mixture to prevent the attacks of black spot (*Macrosporium Solani*).

The average yield is about 20 lbs. per plant and the first fruit is ripe towards the end of November.

FRUIT-GROWING

1429 – **A Wind-break Tree to be tried in Libya.**

BRUTTINI, A. Una pianta frangivento da sperimentare in Libia. — *L'Agricoltura Coloniale*, Year VI, No. 8, pp. 336-338. Florence, August 1912.

When it is desired to render waste lands cultivable in places much swept by hot and violent winds, one of the principal questions requiring attentive consideration is that of screens from the wind.

The climate of Libya does not, like northern climates, allow of a large selection of wind-break plants. Further, in consideration of the small efficacy presented for this purpose by mud walls and cactus hedges, recourse must be had to some plant possessing the property of resisting the arid, sandy limestone soil and the desert wind, and which moreover is rapid in growth, very hardy, and remains always covered with dense foliage. These properties are found, according to the author, in a plant hitherto little known, a species of *Myoporum*.

This is an evergreen, and is a shrub or a tree in habit according to the method on which it is trained. It belongs to the family Selaginaceae, tribe Myoporinæ, the most widespread species of which in Sicily known to the Author is *Myoporum serratum* R. B. (*M. tasmanicum* D. C.).

Myoporum originates from Australia, and several specimens of it have been grown in the Botanical Garden at Palermo for more than 50

years. By that Garden it was successively disseminated in the public and private gardens of Trapani, where it is found in large numbers and in such condition as to allow of being tried as a wind-break in arid, limestone sandy soils, even exceedingly close to the sea, from which very often the scirocco, the representative of the *ghibli* of the Libyan desert, blows violently.

From the Italian habitat of this plant it is inferred that it prefers a very mild climate, and that it is satisfied with very loose soils even if remarkably rich in limestone and shallow. It does not thrive in compact soils. The sea wind does not injure it by its salt and if it breaks the branches, and even the trunk, the plant does not die, because fresh branches are put out by the remaining parts.

This *Myoporum* may reach a height of 16 to 20 feet, and has a rather twisted trunk, gnarled and creviced in the adult plant. The branches are numerous, provided with secreting nodes and with greyish violet bark. The leaves, always abundant, are entire, rich in parenchyma, lanceolate, up to about 4 in. in length and 1¼ in width, exceedingly rich in visible pores, whence the name of Myoporum. The flowers are hermaphrodite, with white corolla, gamopetalous, small and united in axillary groups. The fruits are drupes of 3 to 3½ in., slightly pear-shaped, with epicarp violet in colour when mature; mesocarp soft, succulent, sweetish, and endocarp hard, with 2 to 4 chambers each provided with 1 to 2 seeds. The flowering begins in May and the fruits ripen in July.

Reproduction is effected easily by natural spread, but if desired to carry it out artificially, the fruits must be placed in the nursery not later than September, because their germinating power is limited. From November to March the seedlings spring up and are ready for transportation to the open ground in the next autumn; they are put down in holes 14 to 16 in. deep. The *Myoporum* can likewise be multiplied by slips and shoots.

It is raised to form a hedge by putting down the seedlings at a distance of 28 to 32 in. from each other; as an espalier, at 4 to 5 feet; and as a tree at 13 to 16 feet.

A very important characteristic of this plant is that it grows rapidly. At the age of one year it reaches 5 feet, and at three easily attains 13 feet. It is also very hardy and requires little or no work of cultivation, which may consist in a few digging operations during the first years of life.

From what it has been possible to observe in Sicily the *Myoporum* does not live more than 35 to 40 years if grown as a tree, and ages even more rapidly if trained up to form a hedge or espalier.

The Author says that in the Trapani country side he did not encounter any important diseases or parasites on the *Myoporum*.

1430 – The Possibility and Frequency of Self-Fertilization in the Cultivated Vine.

GARD, M. Possibilité et fréquence de l'Auto-fécondation chez la Vigne cultivée. — *Revue de Viticulture*, Year 19, Vol. XXXVIII, No. 975. Paris, August 22, 1912.

The conditions of fertilization are better known in wild species of vine than in the cultivated ones. In every case, cross-fertilization exists. The numerous male flowers, which have long stamens, blossom abundantly and for a long time, and fertilize the hermaphrodite individuals, which have short, recurved stamens and pollen incapable of fertilizing the pistil of the same flower.

The conditions are different in the flowers of the cultivated vine; these are all hermaphrodite and have long or average stamens and very active pollen. Thus, the possiblity of cross-fertilization admits of no doubt. (Hybrid Bouschel etc.) The following experiments show that self-fertilization is equally certain.

I. — The writer isolated a certain number of full-blown flowers on secondary peduncles long enough to admit of enclosing them in small bags of strong tissue paper attached by a thread.

Cabernet-Sauvignon	8	flowers	7	set fruit
Syrah	14	"	all	set fruit
Sémillon (on 3 different vines)	10	"	7	set fruit
" "	9	"	all	set fruit
" "	4	"	1	set fruit
Muscadelle	7	"	6	set fruit

The study of the conditions of the last flowering confirms these results in every respect. Most of the grapes, which were already several millimetres in diameter, were still covered by the corolla cap, which encloses the stigma and stamens, at all events in the case of flowers which have been fertilized before the 16th of June in the Bordeaux district.

This fact is striking in all the vines (Malbec, Merlot, Cabernet-franc, Cabernet-Sauvignon, Carmenère, etc.), but is especially noticeable in the case of Syrah, where the cap still persists on grapes of 6 to 7 mm. This also occurs in Muscadelle. Self-fertilization seems to be the rule for these last vines, the grapes of which do not habitually drop off.

After the 16th. of June, the temperature rose considerably and the flowers of all the varieties were then seen to open normally, but most were already withered.

II. — The writer castrated, with all the necessary precautions, a whole bunch on a Sémillion vine and left it exposed to the air. This vine bore many other bunches, the pollen of which could fertilize the castrated one: of 105 flowers, 46 dropped off, *i. e.* 62 %.

The writer also castrated all the flowers of the only bunch on a Muscadelle vine, which could only be fertilized by the pollen of another vine of the same variety ; of 74 flowers, 46 dropped off, *i. e.* 43 %. These experiments, compared with those mentioned above, seem to show that, in the case of Sémillon and Muscadelle, self-fertilization gives better results then cross-fertilization.

III. — Parthenogenetic development might be conjectured, but *a priori* it seems unlikely, although the cases of parthenogenesis in Phanerogams have proved fairly numerous. The writer castrated a whole bunch of Muscadelle and enclosed it in a paper bag. He did the same to 25 flowers of Malbec, and 15 of Syrah. None of the ovaries developed.

IV. — The writer considers that the theory of the capping of the blossoms is not sufficient to explain satisfactorily the absence of fertilization.

1431 - **The Vineyards of the Jura.**

JOUVET, F. Le Vignoble du Jura. — *La Vie Agricole et Rurale*, No. 39, pp. 321-326. Paris, August 17, 1912.

The Jura grape country comprises two distinct regions : the " Côte " proper between the mountain and the plain, in the districts of Lons-le-Saunier and Poligny, and the region of hills lying north of the district of Dôle, between the valleys If the Saône and the Doubs. The " Côte " is formed by the slopes of the first plateau, from Saint-Amour to Salins, for a length of about 50 miles with a width of 1½ to 6 miles. This long strip, facing west, is intersected by valleys, deep, narrow and crooked, which penetrate the sides of the mountains to a greater or less extent. The enormous cliffs of Jurassic limestone which bound the first plateau on the west, screen the vine land against the cold winds of the north-east, concentrate the heat during the summer and allow the vine to ripen its fruit under good conditions. Finally, numerous foot-hills of the Jura scattered here and there at a short distance from the great slope form very broken hillocks which are likewise highly favourable for vine growing. The altitude of the vine country on the " Côte " lies between 250 and 400 m. (800 and 1300 ft.), averaging 280 to 350 m. (900 to 1150 ft.), that of the plain being 180 to 250 m. (600 to 800 ft.) and that of the first plateau 500 m. (1600 ft.) and more. With regard to the vine land of the Dôle, it likewise lies on the secondary soils surrounding the massif of primary rock covered by the forest of " La Serre " and emerging between the Morvan and the Vosges. Its altitude ranges from 225 to 300 m. (750 to 1000 ft.).

The *soil* of the vine-growing country is extremely variable ; generally clay-with-flints and alluvia are found in the valleys ; iridescent marls at the foot of the hills ; the three horizons of the Lias on the slopes ; and

different Jurassic strata and landslipped masses in the upper part of the hills, according to the region. The iridescent marls, and above all the blue marls of the Lias, forming a curving and almost uninterrupted line from Cousance to Salins, yield the best wines.

Area of the Vineyards. For various reasons (phylloxera, mildew, bad market and shortage of labour), the area of the Jura vineyards has fallen off considerably since 1879. The following figures indicate the area of land under vine in 1879 and 1911 for each district :

	1879	1911
	acres	acres
District of Lons-le-Saunier	28 740	17 490
" Poligny	12 971	6 158
" Dôle	9 165	3 880
" Saint-Claude	395	25
Total . . .	51 270	27 552

The 27 552 acres existing in 1911 are distributed as follows :

Young vines of 3 years and under	464	acres
Grafted vines over 3 years	24 352	"
Direct producers	2 305	"
Old vines	370	"

Up to now, reconstitution has been carried on by grafting the local stocks, but for some years past a fairly pronounced extension of direct producers is observed, above all in the district of Dôle, where the grape-growers endeavour to produce wine for their consumption with the least amount of tending.

Stocks. — The stocks cultivated in the Jura are very numerous and may be classified into two large groups : the " fine stocks," Poulsard, Trousseau, Pinot-noir, Savagnin-blanc and Chardonnay ; and the " common stocks," Enfariné, Petit and Gros Béclan, Gamays-noirs, Argant, Valet-noir, Mondeuse, Gueuche and Melon.

Chardonnay is by far the most widely represented stock in the Jura.

Pruning the Vine. — Pruning in the manner known as " en courgée " for the fine stocks, is the true characteristic of Jura vine cultivation. The long canes are bent over so as to form a half-circumference or " courgée," the branch being attached to the prop near its base and at its free end. Further, the branch being bent over and fastened by means of an osier below the third or fourth eye, this osier to some extent plays the part of the annular incision in promoting the growth of the fruits on the buds beyond the point of fastening. These buds are furthermore pinched to four or five leaves above the last bunch, especially those at the end of the "courgée " which are always the most vigorous.

The three or four buds at the base of the " courgée " grow freely and it is the third or fourth which will be selected to form the " courgée " in the following year. According to the vigour of the vine, one, two, three and even up to five " courgées " with 8 to 12 eyes per stock, are left attached to as many props arranged in a circle. In vines trained on wire, the courgées, attached at their base to the second wire and at their free end to the first wire, are made in the same way as when props are used, but they are then in the same plane.

With regard to the common stocks, they are according to the vigour of the stock and their lesser or greater fruiting, either cut in " courgées " or with five to eight shoots or " bacots " having two or three eyes, arranged cup-wise for the propped vines and fan-wise for the wire-trained vines.

Operations of cultivation. — These are carried out by hand and are few: digging in April and May ; after-cultivation at the end of May or beninning of June, after flowering, and hoeing in July-August and sometimes in March, inmediately after pruning, on land invaded by weeds. In ploughed vineyards the operations are more numerous; they comprise two ploughings, one in the autumn and the other in the spring, and two or three horse-hoeings during the summer, according to the condition of the soil and the year.

The Jura Wines. — The very frequent spring frosts and the considerable damage frequently caused by hail, cause the production to vary considerably from year to year. Since the year 1900 the crops have been as follows :

1900	7 040 000	gallons
1901	6 820 000	"
1902	5 300 000	"
1903	5 720 000	"
1904	3 240 000	"
1905	7 590 000	"
1906	6 974 000	"
1907	3 150 000	"
1908	11 670 000	"
1909	4 380 000	"
1910	374 000	"
1911	2 600 000	"

This makes a yearly average of 5 566 000 gallons of a value of £280 000 to £320 000. The wines of the Jura may be classified as follows :

I. Red Wines . { Fine wines ; Ordinary wines.

II. White wines { Yellow wines, called Château-Chalon ; Etoile and similar wines ; Ordinary wines.

III. " Vins de paille."

I. Red wines : fine wines. — The fine red wines are produced by the Poulsard-noir, Trousseau and Pinot-noir. These wines, of a fine brilliant red when young, acquire a special " onion-skin " tint as they age. In good years, such as 1904,1906,1908 and 1911, they easily reach a standard of 12 to 13° of alcohol. The prices, which vary greatly, lie between 50 and 80 francs per hectolitre (1*s.* 10*d.* to 2*s.* 10*d.* per Imp. gallon), the highest prices being obtained for the wines of the Arsures, Arbois and Salins, which possess the most famous vineyards.

Ordinary wines. — These, which are produced by the common stocks mixed in variable proportions, fetch from 20 to 30 fr. per hl. (8½*d.* to 1*s.* 1*d.* per gall.) according to the quality and abundance of the grape.

II. White wines : Yellow wines : The yellow or keeping wines, known as Château-Chalon, are produced by the Savagnin gathered very late. Owing to their very high alcoholic strength (13 to 15°), they can keep from 50 to 60 years and more. Delivered from the press, yellow wine sells at 60 to 80 fr. per hl. (2*s.* 2*d.* to 2*s.* 10½*d.* per gall.) in good years, and after casking from six to eight years it fetches 200 to 400 fr. (7*s.* to 14*s.* 5*d.* per gal.) for bottling. The principal vineyards are : Château-Chalon, Pupillin, Arbois, Menétru, Nevy-sur-Seille, Voiteur and Lavigny.

Etoile and similar wines. — This is the description applied to the white wines obtained from the Chardonnay, Poulsard-noir, Trousseau and Pinot-noir, treated to obtain white wine. These wines usually have a grade of 10 to 12° of alcohol and even 13° in good years ; they are largely used for the production of highly appreciated sparkling wines which are easily capable of rivalling the sparkling wines from other parts of France. They are also consumed as dry white wines. The renowned vineyards are : l'Etoile, Quintigny, Ménétru. The prices generally range from 35 to 40 fr. per hl. (1*s.* 3*d.* to 1*s.* 5*d.* per gall.) at the press.

Ordinary white wines. — These are obtained from the Melon, Gueuche-blanc, and Poulsard-blanc or a mixture of these grapes with Chardonnay and Poulsard. As a rule they grade 8 to 10° of alcohol.

III. Vins de paille. — The production of " vin de paille " is very limited. It is obtained as follows : the best grapes (Poulsard, Savagnin, Chardonnay), selected during the gathering, are spread on hurdles covered with straw or hung on poles in warmed rooms. In January or February, when the bunches of grapes have partly dried, they are pressed in small presses. The liqueur-like must emerging is put into the cask where it ferments very slowly, but the conversion of sugar into alcohol is never complete.

After eight to ten years' casking this liqueur wine is bottled, where it acquires an extraordinary bouquet. It is then worth 5 to 8 fr. (4*s.* to 6*s.*6*d.*) per bottle.

1432 – **The Cost of Vine-Growing in the Cognac District, France.**

HENNESSY, JAMES: Le prix de culture de la Vigne dans la région de Cognac, France. — *L'Informateur*, Year 5, No. 44, pp. 293-295. Paris, July-August, 1912.

From the data supplied by many well-known vine-growers, who are members of the Viticulture committee of the Cognac district, in spite of the considerable variation in the figures given in their reports, it appears that the cost of the maintenance and cultivation of one acre of vineyard is about £16. This figure includes, as the following table shows, not only the annual cultural expenses, but also the redemption of the cost of planting in 15 years of good production, the rent of the ground, and the redemption of the material and of the stock. It supposes in all cases an intensive cultivation, which is alone capable of furnishing paying crops.

Plantation of 10 *hectares* (25 *acres*) (*the average size of vineyards in the Charente district*). *Annual Expenses.*

	£	s.
Rent of ground and of buildings: 25 ac. £17 15*s.*; buildings £8	25	15
Cost of planting at £50 per acre, including the expenses of the three first years, to be redeemed in 15 vintages. Annual redemption	80	
Annual cultural expenses. Labour	80	
Manures	53	10
Chemicals	24	
Tying material, replacing stocks and poles	13	
Vintage expenses	32	
Maintenance of 2 horses, at £16	32	
Redemption and insurance of 2 horses £9 10*s.*; harness, shoeing, veterinary, £12 15*s.*	22	5
Various taxes, delivery of crop	14	
Wine-making plant, to be redeemed in 25 years	5	5
Cost of office and administration	9	
Total (rounded off)	£400	

According to the yield of the vineyard, and reckoning the average alcohol degree of the wine at 8°, the production of 1 Imp. gallon of brandy costs the owner from 4*s.* to 6*s.*

In the ten years' period of 1900-1909, the prices in Grande Champagne varied from 9*s.* in 1903 to 5*s.* 3*d.* in 1907, with an average price of 7*s.* per Imp. gallon; in the Bons Bois, the average price was 5*s.* 4*d.*, with a maximum of 7*s.* 6*d.* and a minimum of 4*s.* 8*d.* Thus, the average price from 1900 to 1909, in the arrondissement of Cognac, may be put at 6*s.* 3*d.*

The disastrous vintage of 1910 brought the price of brandy to 8*s.* 6*d.* for Grande Champagne and 7*s.* 6*d.* for Bons Bois, *i. e.* about the maximum of the preceding decade.

1433 - **Pear Growing on a Large Scale.**

DEUMIÉ, M. Le Poirier en grande culture — *Le Progrès Agricole et Viticole*, 29th Year, No. 30, pp. 119-127. Montpellier, July 28, 1912.

The author thinks that vine growing in the South-West of France will probably be less and less remunerative in view of the constant increase of the plantations, both at home and abroad, in more favoured countries. He therefore recommends growers in that region to devote themselves to pear growing on a large scale ; pears succeed admirably in the region, giving magnificent fruit, which finds a ready and profitable market.

Success requires that plains, wet and low valleys — which are too often visited by spring frosts — and mountains and plateaus swept by the autumn winds, should be avoided, and medium levels, well drained and well sheltered, kept to. Furthermore, by grafting on wild pear the fruit is too small, so that quince stocks should be used.

Pears are fastidious as to the physical and chemical nature of the soil ; they like depth, moisture and fertility. The pruning, which influences the size of the fruits, is more difficult to carry out than that of the vine. For all these reasons extended pear growing offers some difficulties, but this will be a bar to over-production.

M. Malpel, deeming that he had found suitable sites, recently entered upon a trial of cultivation on a large scale on some of his properties in the department of Tarn-et-Garonne. At Pompigne, commune of Lavilledieu, 6000 pear trees, planted last winter, occupy an area of five acres. There are 30 000 trees in preparation in the nurseries which will gradually be put out to replace the perishing vines. On two other estates the same land-owner is conducting experiments on different soils ; the effective total is about 10 000 trees. M. Malpel is, so far as the author knows, the first innovator in the South to carry pear growing beyond the limits of the garden and the orchard.

For this trial the William pear was selected, as it best fulfils the requirements of cultivation and markets (England and Germany), under consideration. It does well on quince, budding late and thus mostly escaping the early frosts. Its fruit, one of the largest among the summer varieties, withstands the wind and is not wanting either in pleasing shape, flavour or colour. Picked when still green, it nevertheless continues to improve, even during transport. It is in great demand in England and reaches its destination almost intact, notwithstanding the little attention given to packing.

The form chosen again, is one of the essential features of adaptation to requirements in the open field. It is the cup shape, which seems to combine the most numerous advantages. The branches, six in number only, inclined less than 45° to the vertical, 1 ft. apart and grown from a very short trunk, are of fairy compact habit. This allows of free access of light

and air, without hindering the natural constitution of the tree. As the height does not exceed 7 ft., the branches may be pruned, looked after and cropped fairly well, without offering any hold to the wind.

The trees, which are 10 feet apart in all directions, leave between them plenty of ground for growth, and space for implements to pass at all times of year. Nevertheless, on the most fertile fields, a row of pyramid pears has been provisionally put in in one direction, the other direction at right angles to it remaining free. While waiting for the cup trees to crop, the earlier fruiting pyramids utilise the soil.

To avoid the expenses of very deep digging over the entire surface, trenches were dug for the plantations in rows on the soils which were rich enough and could support closer planting, and holes for the plantations in squares on poorer soil.

1434 – A New Stock for Oranges.

TRABUT, L. Un nouveau Porte-Greffe pour les Orangers — *Revue Horticole*, 84th Year, No. 16, pp. 379-381. Paris, August 16, 1912.

The natives of North Africa have two manners of propagating orange trees : in most instances they resort to the sowing of a good fruit ; the tree takes about fifteen years to grow, assumes a fine shape, and generally yields good fruit. These ungrafted orange trees were formerly fairly abundant in all the mountain ravines on the coast where irrigation is easy, but fine specimens for sowing have been largely destroyed by foot disease, or rot of the bark on a level with the ground. This is a serious infection, which is very much promoted by the bad habit of guiding the water into a basin at the foot of the tree.

In the desert region where oranges are still grown, propagation is carried out by grafting on a slip or layer of a citrus taking root easily. Unfortunately all these native stocks are sprung from *Citrus Limonum* and their resistance to the foot disease is very doubtful.

In Morocco, among the Beni-Snassen another very special stock is used, the " M'gergeb," which has generally been taken for a citron tree, but which may very well be a cross of the citron and the orange. This stock is resistant to the foot disease, whereas the citron is lamentably deficient in that respect.

The " M'gergeb " may very usefully be employed for grafting varieties such as the Pomelos, which are too vigorous to reach their full growth on the roots of Seville orange. The Pomelos being on the other hand practically immune against foot disease, there would be every advantage in propagating these citrus trees, already much in demand in America, by slip-grafting with the aid of the " M'gergeb ". The " M'gergeb " will thus also render service in the multiplication of *Citrus japonica* or Kumquat,

which succeeds poorly on Seville orange, and which is only grafted on *Triptera* in Japan.

At the present time it would be unwise to use " M'gergeb " in clayey soils, but in light and very healthy soils, the old practice of the Moroccans should form an incentive to a few trials. The great interest presented by this new stock lies in the surprising facility with which it lends itself to propagation by slips and the rapidity of the fruiting of trees grafted on this stock.

Ornamental horticulture may, by the system of preliminary grafting of a piece of " M'gergeb " on a branch of the mandarin tree, obtain young slip subjects raised in pots, and yielding fruit at once. The " M'gergeb " subjects also appear very useful for receiving, in all seasons, grafts of the varieties introduced from foreign countries. The side graft almost always succeeds under these conditions.

It is difficult to fix the geographical distribution of " M'gergeb " outside Morocco. Ferrari mentions the Canary Islands and the Azores.

FORESTRY

1435 - The Selection of Forest Species in Russia.

PARASHINK, V. Ob Organisazii Selekzii Liesnikh Rastenii V Rossii. — *Selskoie Khoziaistvo i Liesovodstvo (Agriculture and Forestry)*, Vol. CCXXXIX, Year LXXII, pp. 213-245. St. Petersburg, June 1912.

Forest species are certainly susceptible of improvement by selection, as is proved by the brilliant results already obtained in this direction for the ornamental trees in parks and roads ; if hardly anything of this has yet been done in forestry (1) this is perhaps due to the habit of regarding the forest as a spontaneous natural product, which may easily be exploited without requiring special care, just like a mineral deposit. But like pulse and cereals, oaks, pines and firs may vary and change, yielding forms with new characters and qualities, which may sometimes by the aid of selective work be fixed and propagated.

Scots Pine. — Among forest species Scots pine holds the leading position in Russia, occupying 30 per cent. of the wooded area and supplying 36 per cent. of the total timber put on the market. It further presents the advantage of growing and taking root very well in even the poorest soils where other trees and ordinary crops would yield no profitable returns. Moreover by its nature the pine is an extremely adaptable plant, as is proved by its being distributed from the Arctic lands down to the sub-tropical zone, and under the most diverse conditions of soil, from poor arid sands to marshes and peat moors. Notable, moreover is its tendency to vary, to " mutation." Thus the cones may assume rounded, elongated, or flattened shapes, whilst their bracts may be smooth or rough, pyra-

(1) See No. 168, *B.* Jan. 1911. (*Ed.*).

midal or flattened ; the length of the needles may also vary from 3 to 12 cm. Finally, the female inflorescences which are normally carried at the ends of each twig to the number of one or two, may frequently increase to 40, forming mutations which might be fixed so as to constitute the basis of more fertile races ; and again the cones, which usually open two years after flowering, towards the end of spring, in certain cases open half a year earlier, late in autumn.

The biology of Scots pine, notwithstanding its many attractions, has up to now not drawn to itself the attention of scientists. In each lot of seeds there is observed the same striking want of uniformity in colour, which up till now had been explained on the assumption that each plant can produce seeds with difference of colours. According to the researches of the author, on the contrary, the same plant always produces the same type of seeds ; and in this relation four races can be distinguished in Russia; plants with black seeds (predonintating race 50 to 70 per cent.), with spotted seeds (30 to 50 per cent.), with brown seeds and with light seeds (2 to 3 per cent. together).

As the ripening of the cones proceeds, the surface of the seed tends to become black ; the black therefore seems to behave like a dominant character in relation to the colours. But all these variations have no connection whatever with the production and quality of the wood or any importance with regard to it.

With respect to these characteristics, from the author's enquiries there emerges on the contrary the outstanding importance of the colour and size of the duramen (heart-wood) in relation to the alburnum (sap-wood) ; these may in fact vary considerably as will be seen from the table on p. 2202.

From the said table it is evident that the ratio between the mass of the alburnum (sap-wood) and that of the duramen (heart-wood) varies within very wide limits. The area of this latter in relation to the trunk may be nearly 16 times less in some cases than that of the alburnum, while in others the two areas are practically equal, under conditions of environment altogether uniform and identical.

Larch. — The larch supplies the excellent building timber from which the Siberian colonists build their houses, and the material, though exposed to weather, remains for a long time quite unaffected. The European larch, however, at the eastern end (Russia) of its area of distribution, is very severely attacked by *Peziza Willkommii* and by *Coleophora laricella*, so as to render its cultivation inadvisable. The Japanese larch on the contrary is almost immune against fungi or insects ; its growth however is less rapid and the quality of timber obtained from it more liable to decay. Is it possible by cross breeding to combine in a single subject the valuable characters of the two types ? With this object the author artificially

Diameter of trunk		Diam. of duramen	Section		Ratio: sectional area alburnum to duramen	Ratio: diam. trunk to duramen
with bark	without bark		area of alburnum	area of duramen		
cm.	cm.	cm.	sq. cm.	sq. cm.		
32.0	25 6	13.5	371 6	143.6	2 6	1 9
22.5	17	4 8	208 9	18 10	11 5	3.5
22 0	15.8	3.8	184 7	11.3	16 7	4.1
40.0	33.5	10	802.84	78 54	10.2	3 3
22 5	16	6	172 9	28 2	6.1	2 6
20.0	12.4	4 5	104.9	15.9	6 5	2 7
25	19	7 8	235 8	47.78	4.9	2.4
27	21 5	7 5	319 0	44 18	7 2	2 8
				average ..	8	3
Trees of 100 to 110 years.						
40	32	13	671 2	132 2	5 0	2 4
43	36	19.5	720	298.6	2 4	1.8
34	29 2	15 2	486 2	181 5	2 6	1 9
41	34	17.5	667 4	240 5	2 7	1 9
50	50	22	880	158 3	4 1	2 2
34	28.8	19 8	347.9	307 9	1.1	1 4
44	35	22	482	380 1	1 2	1.5
58	50	34	1056	907 9	1 2	1 4
				average .	2 5	1 8

fertilised specimens of European larch with the pollen of the Japanese species. The hybrids of one year can already be seen on a plot of the experimental field at Nova Alexandria, but nothing can as yet be said.

Oak. — In the common oak we have early specimens and late specimens. The latter flower four to six weeks later, avoiding the injury of the spring frosts ; owing however to the lesser duration of the period of growth, they accumulate a more limited quantity of organic substances and their

growth is consequently slower than that of early specimens. These latter are therefore preferable wherever the conditions of climate permit; hence the desirability of determining on the basis of weather data, the optimum zone of distribution of early flowering oaks, rigorously excluding the late type.

Importation of exotic species. — The selection and acclimatization of valuable exotic species is also called upon to perform a great part in the work of selection in forestry. The geographical distribution of many forest trees is determined not only by agro-geological and meteorological conditions, but in a still greater degree by the instability of the configuration of the lands which have since the most remote geological epochs been subject to alternating movements of emergence and subsidence, which perhaps sub-divided the continental masses into islands; some of these latter remaining such until our own day and others once more merging into united territories. Thus it happens that plants transported to another place, even under distant latitudes, thrive better than in their place of origin. For instance, the horse chestnut, which in the Government of Lublin, Baltic Provinces, grows more luxuriously than in Greece; and the Douglas fir, which being introduced from North America, succeeds excellently in Germany and elsewhere, as well as in Russia where it was only introduced a few decades ago. Hence the desirability of ascertaining exactly the geographical distribution of the most valuable species. The best conditions of growth for a given plant having thus been determined, it will always be possible to introduce it successfully by artificial means, wherever the same conditions recur, sometimes indeed very far from the natural zone of diffusion, limited by obstacles in the form of mountains or arms of the sea, which the seeds of the tree are not able to traverse without the intervention of man.

Afforestation of arid zones, at present bare, by the introduction of foreign species, which under the like conditions elsewhere had shown progressive adaptation to such dry environment, for instance by developing the root system to a greater extent downwards, is one of the problems of the utmost importance.

Furthermore, when the introduction of exotic species is accompanied by crossing with local species, eliminating from both their useless or injurious characters in order to combine in a single type the most valuable characteristics of the two, the field of selection in sylviculture is substantially extended; we have, indeed referred to the endeavours made by the author with the European and the Japanese larch to secure a variety immune from *Coleophora laricella*; we shall now recall the brilliant results obtained by Burbank, by hybridising *Juglans nigra* with *Juglans regia*. Three hybrids of the first generation planted in 1892 had grown in 1905, that is

13 years later, into magnificent trees 85 ft. high with a diameter of nearly 28 inches.

The selection of forest species in Russia. — The problem of the forest in Russia is of an urgent and immediately pressing character. Re-afforestation and the orderly arrangement of the mountain basins in the Caucasus, the afforestation of the steppes, and re-afforestation in Turkestan constitute a few of its many important aspects. The solution of these problems is being dealt with by eight experimental forests scattered through the territory of the Empire and assisted by the Seed-Control Station at St. Petersburg. The task entrusted to these Stations is precisely to study the effect of the soils and weather agents on the life of the plants, the different types of formation, the methods of preparation of the timber, etc. The author enquires whether it is possible also to hand over to the said Stations the matter of the selection of the forest species, which as is evident from what we have said above, is not merely possible but has become an urgent need in serious and rational work of sylviculture. According to the author the problem of selection is so wide and complex, the knowledge required is so special and different from that regarding forest management, as to render indispensable the creation of special Stations, if it is desired to meet the "urgent necessity of initiating in Russia the selection of forest species," a necessity unanimously recognised by the first National Congress of Selectors in St. Petersburg. On the other hand again, the task entrusted to the eight forest stations is sufficient to absorb their fullest energies.

The programme of work of a future Station for the selection of forest species should therefore be mainly:

1. The study of the biology of the principal forest species, their tendency to variation, mutations, geographical races, etc.

2. The introduction and acclimatisation of valuable exotic species.

3. The creation, by means of cross fertilisation and selection, of new types with good wood-producing qualities, of rapid growth and at the same time resistant to insects and diseases.

4. The elaboration of new special methods of selection more in keeping with the objects and problems of sylviculture.

1436 – The Pulpwood Output of Canada.

MACMILLAN, H. R.; assist. by Mc DOUGALL, E. O. and BOYCE, W. G. H. Forest Products of Canada, 1911: Pulpwood — *Department of the Interior, Canada, Forestry Branch, Bulletin* No. 30, 17 pp. + 6 tables + 3 diagr. Ottawa, 1912.

Canada is becoming perhaps the greatest pulpwood producing country of the world, and it will be interesting to gain an insight into this important forest production from the data reported for 1911 by the Canadian Government.

The 54 firms reporting, used, in 1911, 672 288 cords. There were exported in a raw state 847 939 cords, making a total cut of 1 520 227 cords valued at $9 678 616. This is 21 401 cords less than were cut in 1910, but the quantity manufactured in Canada was larger. Over 95 per cent. of Canadian mills cut the pulpwood used by them from their own limits and consequently rose the wood themselves.

Quebec is the premier pulpwood province of Canada because of its extensive spruce and balsam fir forests fit for pulpwood, its abundant and cheap water power, and its plentiful supply of labour. The 28 mills in Quebec report a consumption of 58 per cent. of the total of Canada. Ontario uses nearly one third of the total production; New Brunswick 6.8 per cent (in 1909 it used 14.2 per cent. of the total). The province of British Columbia is still experimenting in pulpwood manufacture, so that the total is made up by Nova Scotia.

From the silviculturist's point of view the distribution of the species used for pulpwood may be of particular value.

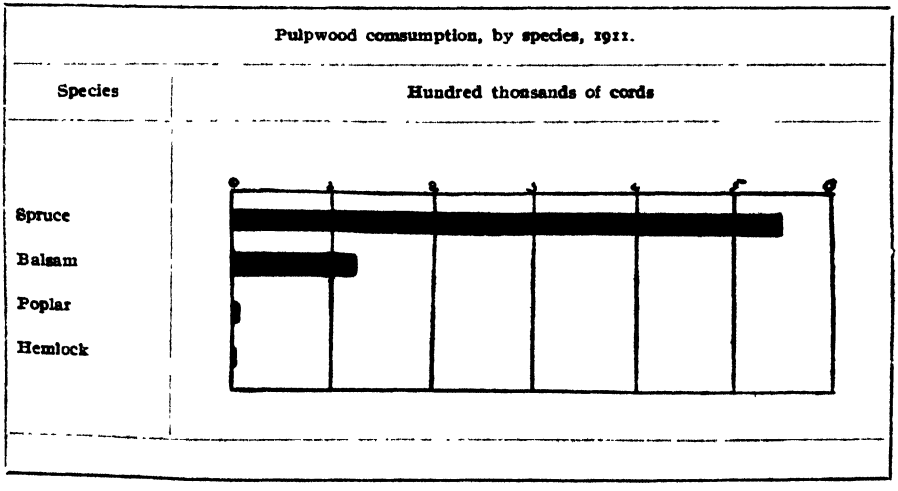
PULPWOOD, 1910 AND 1911, BY SPECIES.

Total quantity, total value and per cent. distribution.

Kind of wood	1910			1911		
	Quantity	Value	Per cent.	Quantity	Value	Per cent.
—	cords	$	—	cords	$	—
Total* . .	598 487	3 585 154	100.0	672 288	4 388 024	100.0
Spruce . .	470 230	2 846 678	78.6	548 276	3 548 824	81.6
Balsam . .	120 475	698 608	20 1	117 400	750 950	17.5
Poplar . .	3 608	21 366	0 6	4 186	25 830	0 6
Hemlock .	3 810	16 922	0 6	1 670	8 640	0 2

*The total contains a small quantity of wood not identified by species.

The situation is forcibly summed by the following diagram.



The increase in the quantity of pulpwood used in 1911 was practically confined to spruce. But, although the reports furnished do not indicate it, the proportion of balsam fir used is yearly increasing. Balsam fir and spruce are used in mixture in the manufacture of news print. A few years ago it was thought that if the proportion of fir was increased above 25 per cent. an inferior paper would result. Greater skill in papermaking has shown that the proportion of fir may be increased to 40 per cent. or over. In various parts of Eastern Canada, particularly in Quebec, balsam fir forms from 20 to 50 per cent. of the forest. The practice of the companies now operating is to take spruce and balsam as they occur in the forest. Poplar has regained third place among pulpwoods, and hemlock retired to fourth place in 1911. There is reason, however, to suppose that a larger export of hemlock took place. Jack pine has not been reported as a pulpwood since 1908; before that time it was used considerably by two large mills, but has proved unsatisfactory. Arrangements are now being made by mills in Ontario and Quebec for a further use of jack pine.

As to the extent to which these species are used in the various processes (mechanical, sulphite, soda), spruce as in former years was the chief wood used in each process. More than half (57.5 per cent.) was made into mechanical pulp; more than one third (33.8 per cent.) was manufactured by the sulphite process, and 8.7 per cent. by the soda process. Balsam fir is being used more than formerly in the mechanical process (76.2 per cent.), and less in the sulphite process (23.1 per cent.); it has also been used in the soda process for the first time in 1911 (0.7 per cent.). Two thirds of the hemlock used (67 per cent.) was manufactured by the soda process, nearly one fourth (24 per cent.) by the mechanical process, and the remainder (9 per cent.) by the sulphite process. Although the physical properties of poplar do not adapt it for grinding by the mechanical process, 5.3 per cent. of the poplar was manufactured by this process in 1911; 51 per cent. was manufactured by the sulphite process and 43.7 per cent. by the soda process.

The average price of the different species used is the cost to the mill-owner, and so includes varying logging expenses and a wide difference in transportation charges. The effect of an excessive hauling distance is demonstrated in Ontario, where the prices of spruce and balsam fir were $6.75 and $7.46 per cord respectively. The high price paid for balsam fir and the sustained demand for this species prove its suitability for manufacture into pulpwood. Over the whole of Canada spruce was the most expensive species in 1911 at $6.47 per cord, or 42 cents more than in 1910. Balsam fir is at $6.40 per cord having risen 69 cents since 1910. Hemlock, though still the cheapest species, advanced in 1911 75 cents per cord, its average price last year being $5.18. Poplar has advanced to $6.17. The cheapest pulpwood bought was a small quantity of poplar in Nova Scotia,

which cost $3 per cord. A small quantity of hemlock in British Columbia at $7.60 was the most expensive wood, on the average, used in Canada for pulping; but as much as $10 per cord was paid for spruce in some cases.

Canada's foreign trade in wood-pulp has not kept pace with the growth of her forest industry. More than half the pulpwood cut is still exported in the unmanufactured form; this is considered a direct loss to the country, for the increased value due to manufacture is given away. The exports of woodpulp to the United States (nearly four-fifths of the total), however, are increasing, so that the decline is entirely in transoceanic markets (restricted chiefly to United Kingdom).

The pulpwood in raw state is exclusively exported to the United States which manufacture it into pulp and paper. The amount paid for this wood in 1911 was $5 340 592, or an average of $6.29 per cord.

Finally, the provincial laws affecting the export of pulpwood within the exporting provinces have changed considerably in 1911. In 1909, pulpwood from private lands in Ontario and from all lands in Quebec and New Brunswick could be shipped to points outside of Canada. In that year, however, the province of Quebec issued more restrictive regulations, which came into force on the 1st of Sept., 1910, prohibiting the export of unmanufactured wood cut on Crown lands within the province, and in 1911 New Brunswick passed legislation to the same effect, coming into force on the 1st of Oct. 1911. The effect of the Quebec legislation is noticeable already in 1911, the export of raw pulpwood from that province having decreased by 142 864 cords, or 18.3 per cent. Its domestic consumption increased by 47 671 cords, or nearly 14 per cent., and 3 new mills were started in addition to several others under construction. In the other provinces taken together, the export of raw pulpwood increased 47 662 cords, or 29 per cent.; the domestic consumption was increased by 26 130 cords, or 10.2 per cent.; and one mill less reported.

It is evident that this legislation is already having the desired effect in stimulating the growth of the industry. All the provinces are now fully alive to the importance of preventing the export of this valuable forest raw material. So far as it is in their power, they have taken steps to prevent it from being carried off to build up the industries of another country; yet more than half, as seen, of the pulpwood cut in Canada is still carried over the border to supply the pulpmills of the United States. Nearly all of this wood is cut from privately owned land, over which the provinces have no jurisdiction. Only the federal authority, it is maintained, by the imposition of a prohibitive export tax, could stop this export. More than twice the number of mills operating in the Dominion, *i. e.* 115 instead of 54, might now be at work, if Canadians had been far-seeing enough to manufacture their own raw wood products.

LIVE-STOCK AND BREEDING

FEEDS AND FEEDING

1437 - **Oryzanin, a Constituent of Rice Husks, and its Importance in Food.**

SUZUKI, U.; SHIMAMURA, T.; ODAKE, S.: Ueber Oryzanin, ein Bestandteil der Reisklete und seine physiologische Bedeutung. — *Biochemische Zeitschrift*, Vol 43, Parts I-II, pp. 89-153 + 1 plate. Berlin, July 29, 1912.

As far back as 1897, Eijkmann had observed that fowls fed solely on decorticated rice lost their appetite and wasted away; he found at the same time a great resemblance between this and the human disease beri-beri. On the other hand, if the fowls were fed with whole rice, they not only felt no harmful effects, but the sickly ones recovered (1). Hence the supposition of the authors that in the husks of rice there is a substance which prevents or cures the above disease.

After four years' investigations and experiments — conducted partly in conjunction with the Director of the Agricultural Experiment Station of Tokio, Y. Kozai, and others — they were able to detect the existence of this body in the alcoholic extract of the husks which had previously been freed from fat. To this body, nitrogenous and of an alkaloidal character, they have given the name of oryzanin.

As a result of feeding-experiments with pigeons (10 experiments), fowls (4 experiments), mice (9 experiments), and dogs (3 experiments), the authors came to the conclusion that in animal nutrition oryzanin has a very special function, as important as that of the nitrogenous substances, fats, carbohydrates and salts; without it, even these latter substances are not able to exert any physiological effect. On feeding the animals with artificial foods made up of albuminoids, carbohydrates, fats and salts, but without oryzanin, the animals could not be kept alive for any length of time: thus, dogs fed on boiled meat and husked rice, after 3 or 4 weeks had completely wasted away; but they recovered rapidly when 0.3 gr. of oryzanin was added.

It would seem that oryzanin is also found in many other food substances such as wheat bran, bread, barley bran, oats, cabbages, "adzuki" beans, soy (to a limited extent), pearl barley (probably), malt and horse-radish; of these barley bran contains the largest amount, about 1/5 of what occurs in rice husks (crude oryzanin, 0.4 %). The greatest importance of oryzanin lies in its function as a constituent of rice husks, especially from the point of view of the diet and hygiene of those peoples who, like the Japanese, make husked rice the basis of their daily diet.

(1) See No. 1130, *B.* Aug. 1912. (*Ed.*).

1438 - **The Progress of Stock Breeding in the State of Sao Paulo (Brazil).**

MISSON, L. Les progrès de l'élevage dans l'Etat de Sao Paulo — *Annales de Gembloux*, Year 22, Part 8, pp. 458-508, fig. 21. Brussels, August 1, 1912.

WORK OF LIVE STOCK ASSOCIATIONS AND OTHERS FOR THE ENCOURAGEMENT OF BREEDING.

The coffee crisis turned the course of Brazilian economy to other industries, which promised more constant returns, amongst which was the cultivation of maize, rice, cotton, sugar-cane and tobacco, while the development of stock breeding came in for a share of attention.

There are, in fact, districts in the State of São Paulo which are eminently suited to cattle-raising, *viz.* the districts of Barreto, Campos di Paranapanema, Faxima, Lençoes and lastly Campos di Jardão. On the other hand, great changes have been introduced into coffee cultivation, which having become more and more intensive, has developed the use of chemical fertilizers and of farm-yard manure to such an extent, that by the side of ranging, a stall-breeding industry is springing up within the boundaries of the coffee plantations for the supply of farmyard manure on the spot. Though the planters thus come to consider cattle as a necessary item of expenditure, it is evident that the time is not far distant when the production of milk and its transformation into butter and cheese will bring them in considerable returns; and this will, of necessity, tend to give cattle-breeding the importance it deserves.

According to the latest official statistics, dating from 1904 and 1905, the number of animals existing in the State of São Paulo was as follows:

Breeding horses	79 718	
Working „	150 637	
Imported „	345	
		230 700
Breeding cattle	307 262	
Productive cattle	430 385	
Imported „	399	
		738 046
Breeding donkeys and mules	1 236	
Working „ „ „	123 501	
Imported „ „ „	80	
		124 817
Sheep	62 814	
Imported sheep	375	
		63 189
Goats	136 028	
Imported goats	121	
		136 149
Pigs	1 283 775	
Imported pigs	671	
		1 284 446
Poultry, etc.		3 909 344

The production, according to the statistics of the same date was:

Milk	17 838 000	gallons
Butter	550 450	lbs.
Cheese	6 903 175	,,
Meat	44 778 200	,,
Bacon	5 240 900	,,
Wool	6 005	,,
Honey	202 200	,,
Wax	62 100	,,

These figures are evidently lower than the present figures, for the increase of population naturally corresponds to a proportional increase in production.

Cattle Breeding: *a*) Native breed. The predominant breed of cattle in the State of São Paulo is the Caracù. These animals have more or less dark buff-coloured coat, with pinkish muzzles and hoofs, and slightly upturned horns of ivory colour with dark or black extremities. They are hardy, and perfectly adapted to the country; but on the other hand, they have sloping rumps and are badly filled in behind the shoulders; the dewlap is also too much developed. The Caracù is not a specialized breed and is used for milk or meat production according to the quality of the pastures; it is excellent for work. This breed, which is now considered as a national one, is descended from Portuguese or Spanish cattle imported by the first colonists. The Government takes much interest in its preservation and also in its improvement by means of selection at the Live Stock Station of Nova Odessa, where the results obtained are very encouraging.

The other breeds, which are less known, because they are represented by a smaller number of head, are the Franqueira, which has the reputation of being a good milker, the Curaleira, which is also a good milk-breed but too small for meat-production, and the hornless Mocho, which seems to have been derived from the Caracù by natural selection. The hardiness of the national breeds and their perfect adaptation to the natural conditions are qualities which facilitate extensive breeding, and it is probable that they will be long preserved unmixed in the large breeding farms of the country.

b) Crosses. On farms whose proximity to the markets is favourable to intensive breeding, much attention is paid to the improvement of the national cattle by crossing them with European breeds. The Central Live Stock Station has examples of the only five European breeds sanctioned and subsidised for importation by the Government: Dutch and Flemish breeds for milk, Schwyz and Simmenthal as dual purpose breeds, Limousine for beef. The Simmenthal breed is destined to be removed before long, for its crosses rapidly degenerate. The Dutch cattle, which have long

been imported, adapt themselves well to their surroundings, and the results of crossing begun more than 30 years ago, are often excellent animals, both as regards shape and milk production. These crosses, which it would be well to continue, could be used for the improvement of the native Dutch breed if bulls for importation were selected from good milking families with a large percentage of fat in their milk.

The Flemish breed, hitherto little known in Brazil, has been carefully studied at the Live Stock Station and the results of crossing it with Caracù cattle are much admired. Thanks to its excellent shape, the Flemish breed rapidly improves the native cattle, increasing their milk production and giving rise to offspring wich are more prolific and which fatten earlier. But it is especially valuable from the point of view of the selection of the Caracù breed and of the creation of a breed which, through the infusion of foreign blood, at once combines the hardy character of the native animals with other qualities in which the latter are deficient.

The Schwyz, crossed with the Caracù, gives good milkers, often superior to the products of crossing with the Dutch ; the bullocks give more meat and make excellent draught animals.

The Limousine breed, which is slightly related to the Caracù (the ancestors of both being the Aquitaine cattle), crossed with the native breed improves rapidly the beef producing qualities of the latter, while preserving the aptitude for work and the docility common to both Limousine and Caracù.

The Government of São Paulo possesses at the Central Live Stock Station a certain number of cattle of different breeds, which have been imported with a view to producing pure-bred breeding animals. The bulls, on reaching a certain age, are sent, as required, to the district service stations ; the surplus as well as imported and acclimatised bulls are sold by auction to the breeders.

To give a practical idea of the breeding results, the following are the data obtained last year at the cow-house of the Station. The Flemish breed is first in milk production, the Guernsey in butter production ; the table shows also how the milk production may be modified, according to the different breeds, in tropical countries.

	Average duration of lactation period	Daily milk yield per cow. lbs.	Annual milk yield per cow. lbs.	Annual butter yield per cow. lbs.
3 Guernseys	221 days	18.06	4292	230.3
11 Dutch	180 „	9.29	3360	103.4
10 Schwyz	158 „	6.92	2506	89.3
2 Flemish	232 „	14.24	5155	213.5
1 Flemish-Caracù	112 „	—	1160	—

The 27 cows furnished 86 379 lbs. of milk, which, at the rate of 2s. 3½d. per gallon, gives a sum of nearly £1 000. The daily cost per head is about 1s. 3½d.; the total annual cost of the 27 cows is £644 7s. The return is £354 4s., to which must be added £431 9s. for the value of 15 calves sold by public auction, or retained for the herd. The total profit from the cows is therefore £785 13s.

Horse-breeding. — The native breed, which is thrifty and resistant, is descended from the horses imported by the first colonists and can be considered as a degenerate Arab. Natural selection has bestowed powers of great resistance upon these animals. These horses are almost exclusively kept for riding, and as they are accustomed to long journeys and to roads rendered almost impassable by the tropical rains, it would be greatly to be regretted if this indigenous breed were not preserved and measures taken to improve its shape and increase its size. By this means remounts could be obtained for the cavalry and by paying good prices for them the Government would encourage such breeding. The Department of Stock Breeding at present possesses the following stallions:

4 Arabs.
7 Anglo-arabs.
2 Andalusians.
1 Engish thoroughbred.
1 Hackney.

The Arabs give by crossing, or better, by selection, good saddle horses; the Anglo-Arabs are best for light cavalry. The Andalusian is used for riding horses, the Hackney for carriage-horses. There is no question of draught horses, since mules are better than horses for drawing loads in hot countries.

Mule Breeding. — For the production of mules, the breeders prefer imported male asses and especially those from Calabria and the Abruzzi. The mules obtained by this means are spirited and strong, and suitable both for saddle and draught animals.

Pig Breeding. — This industry is one of the most important in the State of São Paulo. The native breeds Canastra and Canastrão differ from the European in that they give very little pork and their bones are very small, while they produce much fat, which causes these animals to be very suitable to a country where the temperature is high throughout most of the year and where it is difficult to keep meat. The present conditions of the market (fat being sought after and meat neglected) cause the native breed to be preferred to imported breeds. Amongst the latter Berkshires and Large Blacks will, on crossing, give paying results as soon as the cold store industry provides better means of preserving meat.

Sheep breeding. — The conditions of both climate and pastures are unsuitable for this industry. The indigenous breed of sheep is small and

little productive and farmers engaged in sheep breeding turn their attention chiefly to mutton and use for crossing Oxford Downs, South Downs, and Shropshire Downs.

Goats. — These are of a somewhat mixed breed, but Alpine and Flemish male goats are imported to improve the native animals.

Poultry. — The Minorca and Bresses breeds are the most esteemed of those imported for crossing, and resist tropical cimates without degenerating.

Acclimatization. — This has been a problem to be studied by the Department of Animal Industry from the date when the importation of European breeds became the basis of its programme for the improvement of stock-breeding. The repetition of the first great failures was immediately prevented by the discovery made by Dr. Carlo Botelho, who proved that the " tristeza " (redwater or Texas fever), which decimated the animals, was due to *Piroplasma bigeminum* and that the highest degree of resistance could be obtained by the importation of young animals from 12 to 14 months old, and by ceasing to bring over young heifers in calf, which aborted and died, and also by confining importation to the winter season and practising natural and artificial immunisation.

The feeding problem was easily solved by the number of fodder crops which grow in the country.

Another disease, more dangerous than the preceding one, gall-sickness, is due to *Anaplasma marginale*, which attacks all imported animals ; fortunately both these diseases can be controlled by the aid of the artificial immunization suggested by Professors Nattal and Hedwen. These investigators obtained by the use of trypan blue the partial destruction of the parasites and thus a lasting immunity of the animal subjected to the treatment ; the inoculation in artificial immunisation is made with the blood of an animal which has been already rendered immune. To prevent anaplasmosis produced by *Anaplasma marginale*, injections are made of the blood of an animal attacked by a less serious form of anaplasmosis produced by *Anaplasma marginale* var. *centrale* ; immunity is obtained thus Dr. Theiler seems to have found that simultaneous immunisation can be practised against redwater and gall-sickness (1). The acclimatization of cattle thus no longer presents the great difficulties which it did formerly, for all cattle coming from abroad are at once and certainly rendered immune. As regards the native cattle, the writer advises the obtaining of immunity by means of natural infection from ticks during early youth before the animals are a year old. This immunization does not

(1) See No. 810, *B.* May 1912. (*Ed.*).

present serious danger, seeing the greater powers of resistance possessed by young individuals.

Subsidies. — The Government of the State of São Paulo has not contented itself with founding a Department of Animal Industry, a Central Live Stock Station and a Selection Station at Nova Odessa. It also gives grants, which enable breeders to obtain in Brazil selected specimens of cattle at the same price as they fetch in Europe. At present, these subsidies for animals of European origin are about :

£32	per head for cattle ;
£38	,, ,, ,, horses ,
£25	,, ,, ,, donkeys ;
£ 9 10s.	,, ,, ,, pigs ;
£ 7 10s.	,, ,, ,, sheep and goats.

Before giving these grants, the Government assures itself as to the conditions of health, the quality, and the most suitable season for importing the animals ; further, grants are only given to animals whose introduction is approved, while those thought to be harmful to national breeding are excluded and the importation of too many new breeds is avoided. Thus, for example, subsidies are refused for the importation of Indian zebus, which the Government considers to be inferior to the Caracú and therefore incapable of improving the native cattle.

Transport by rail. — The Government has also interested itself in the question of transport, which, by ensuring the arrival of the animals in good condition, contributes greatly to the success of acclimatization The best method of transport for horses is in simple un-padded boxes, where the animal is by itself and loose. Donkeys are transported in the same way, with the difference that 5 to 7 animals can be placed in the same box, provided they are fastened up. For cattle, ordinary trucks are used containing 8 to 10 animals attached to the sides by fixed rings Goats, sheep and pigs are transported in large trucks and loose, care being taken to separate the different breeds, as well as the sexes. Hygienic measures are rigorously observed and a competent staff is chosen by the purchaser to accompany the animals. It is well to take out an insurance policy against the risks of mortality due to disease or accident during the journey. When the latter is long, and the laws of the country of embarkation permit it, the cattle arrive some days before the departure of the boat and are unloaded and allowed to rest in the shed before being shipped.

Transport by Water. — The first precaution is the choice of a ship of large tonnage, which is rapid and possesses the maximum of guarantees as regards safety. The stalls are only used once, and are made of new wood, their dimensions being as follows :

Horse box	5 ft.9 × 9ft.10 × 8ft.3.
Donkey box	4ft.11 × 8ft.3 × 7ft.4.
Cattle stall	4ft.11 × 8ft.3 × 7ft.4.
Goat stall	3ft.3 × 4ft.1 × 4ft.1.
Sheep and pig stall	3ft 3 × 4ft.1 × 3ft.3.

The boxes are covered with thin boards on which are nailed waterproof sheets which protect the animals from the rain and the tropical sun.

The writer describes these stalls, which have always given complete satisfaction, as have also the feeding precautions taken, the choice of the staff of attendants accompanying the animals, etc. The following are some of the prices of transport from Europe to Santos:

One horse from Bordeaux to Santos	£47 10s
One ass ,, ,, ,, ,,	£37 15s
Pigs and sheep from Southampton, each	£ 7 15s
One bull from Antwerp to Santos	£33 15s
One goat ,, ,, ,, ,,	£ 7 15s

District Studs and Service Stations. — In order to complete the organization, Live Stock Stations have been established to serve as district studs; in the most suitable places there are also Service Stations, especially for horses, which are destined to free the country from the necessity of foreign purchase.

Fodder Crops. — The natural pastures, which are to be found in the most distant parts of the State of São Paulo, are replaced within a radius of 250 to 300 miles from the capital by artificial pastures, where "jaraguà" (*Andropogon rufus*) and "catingueiro" (*Melinis minutiflora*) predominate. "Jaraguà," which grows more than three feet high, is found on the richest land and becomes very tough in the dry season; it can then be burnt, and the burnt tufts sprout again immediately after the first rains, giving rise in September to a tender juicy grass much appreciated by cattle. The "gordura" or "catingueiro," so called from its disagreable odour, possesses amongst other advantages that of being free from ticks, so that cattle which graze on it are less often attacked by these parasites. The yield of these two grasss is enormous; the average yearly production per acre may be estimated at 54 tons for "catingueiro" and 47 tons for "jaraguà." A table of the comparative yields of the various fodder crops grown in the experimental fields of the Central Live Stock Station gives the plants which, for the most part, are cut 5 to 7 times a year; this shows that there is no difficulty in finding the fodder necessary for cattle feeding.

Grass	Average yield per acre
	tons.
Capion d'Angola(*Panicum maximum*)	77
Capion Colonia (*Panicum* sp.)	69
Milka de Batataes (*Panicum* sp.)	52 ½
Graminka (*Cynodon dactylon*)	31 ½
Chloris vergata	54
Paspalum dilatatum	43

To these grasses must be added the forage reed which yields very large crops ; one cut may give, according to the variety, from 79 to 100 tons per acre ; the sweet potato which gives 44 tons of leaves and more than 13 tons of tubers ; the manioc, vetch, and spurrey which, sown in autumn, give during the winter, 2 to 3 crops of excellent forage.

Veterinary and Sanitary Service. Shows. — The Government is engaged in organizing a regular veterinary service dependant on the Secretary of Agriculture and which already consists of three French and two Italian veterinaries. Further, Shows are held regularly every year at the Live Stock Station of São Paulo, and are becoming increasingly important.

The progress of live stock breeding in the State of São Paulo has suggested to the Federal Government the idea of instituting a Department of Animal Industry and a Central Live Stock Station, with aims similar to those of the Station of São Paulo, but with a much more extensive field of action, reaching at any rate to all the southern States of Brazil.

CATTLE

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II. — Introduction.

The testing of the yield of dairy-cows has of late years been introduced into many countries, and Governments have done much to promote its extension. It may therefore be of interest to consider the progress so far made by this comparatively new departure in live-stock breeding in the different countries.

In the following account we shall first notice shortly the tests made at shows and then pass on to tests lasting for a longer period of time carried out by Breeders' Associations and Cow-Testing Associations (the latter following the example of Denmark). Tests carried out at Agricultural Colleges or individual farms are not included.

III. — Tests at Shows.

The Royal Agricultural Society of England first instituted milk-testing in 1885 at the show held at Preston. In 1903, they proceeded to testing butter yield. Both tests are now retained at the annual shows of the society. The cows are milked dry at 5 p. m. on the day before the tests

are made, and the milk or butter yield in the follwing 24 hours is accurately determined. The lactation condition is taken into account in judging the performance of the animal. The cows are also divided into classes according to their age or weight. The British Dairy Farmers' Association instituted similar tests of 48 hours' duration. The English Jersey Cattle Society and the Royal Jersey Agricultural and Horticultural Society have held 24 hours' butter tests at their exhibitions since 1886 and 1887 respectively. The German "Landwirtschafts-Gesellschaft" also carried out a short milking test at their first exhibition at Frankfurt-on-Maine. At the Chicago World Fair in 1893, milking tests on 75 cows (Shorthorns, Guernseys and Jerseys) were carried out lasting from May to September. Milking-tests were also held at the Pan-American Exhibition at Buffalo in 1901, at the Hygiene Exhibition at Hamburg in 1903, and at the World Exhibition at St. Louis in 1904. In France, a "Concours beurrier" was held at Forges-les-Eaux in 1906, and at Rouen in 1907. In Italy, in 1908 the "Associazione Agraria Friulana" held a milking test lasting for 24 hours; similar tests have also been carried out during the last two years at Bergamo. In Canada "milking competitions" have lately been a feature at several large cattle fairs. In Queensland the Rockhampton Agricultural Society carries out milking tests in connection with its annual shows.

Tests of the milk and butter yield of cows at exhibitions or similar competitions serve to arouse interest in the subject; but owing to their short duration, and the unusual conditions under which the cows are living, they give no very reliable data for judging the performances of the animals. These can only be obtained by keeping regular records for a longer time.

IV. — Milk and Butter Tests of longer Duration.

A. Tests instituted by Breeders' Associations.

Before the first Cow-Testing Associations were started in Denmark, breeders' associations had begun to test the milk yield of animals entered in the herdbooks, and such testing has now become more general, especially in North America. Table I (pp. 2222 and 2223) gives a list of such Associations, with the dates of their first tests, the length of the tests made, and the extent of their testing work.

In the *United States*, the Dutch Friesian Breeders' Association, at the instance of their secretary, S. Hoxie, was the first Breeders' Association to institute milk yield tests for herdbook animals, and to enter the results in a special register. In 1885, the above Association combined with the Association of Breeders of Thoroughbred Holstein Cattle to form the Holstein-Friesian Breeders' Association of America, which carried on the milking tests further. The present form of the "official" tests of this

society dates from 1895; most of them extend over seven consecutive days; some, however, last for 30 days or longer. Both usually take place shortly after calving (the commencement being not sooner than 6 days after calving), but some tests are begun 8 months after calving (eight months' tests). During the last 7 years, "semi-official" yearly or lactation tests have also been made, lasting not more than 365 days.

Only animals registered in the herdbook or those about to be registered are admitted to the tests. After the owner of the cow has communicated with the Association and with a State Experiment Station, a supervisor, deputed by the Experiment Station in question, visits the farm to carry out the official tests. He ascertains the weight of milk given by the cow under observation each milking time and examines a sample with the Babcock tester to determine the fat content. He also takes 1 cc. of milk per pound of weight each time the cow is milked in order to test the whole amount of milk, a sample of which must be forwarded at the close of the testing to the Experiment Station to which the supervisor belongs. The supervisor has also to send a report of the details of the testing to the office of the Association and to take an oath that this report is a true statement of facts.

In the case of the semi-official tests, a method of procedure similar to the above is carried out each month on two consecutive days by an official of a State Experiment Station, who informs the Association of the result. On the remaining days, the owner is pledged to determine daily the accurate weight of each milking and to forward a detailed report every month (written on a special form) to the office of the Association. The butter yield of the cow under observation is reckoned from the fat content of the milk as determined by the supervisor and from the monthly milk yield, prepared by the owner and controlled by the supervisor.

The cost of the testing is defrayed by the owner; not reckoning board, lodging, and travelling expenses of the supervisor, this amounts to about 2.25 dollars (9*s.* 3*d.*) per day.

Every cow whose performance reaches or passes a certain level is entered in the Advanced Register of the Association, which is a supplement to the Herdbook. The lowest yields necessary for entry depend on the age of the cow. Cows which have calved at the exact age of 2, 3, 4 or 5 years, should give, on 7 consecutive days, 7.2 lbs., 8.8 lbs., 10.4 lbs., and 12 lbs. of butter-fat respectively. For every day that the cow is over 2, 3, or 4 years, the amount of butter-fat yielded is increased 0.00439 lb. For "eight months' tests" neither the yield nor duration of time are prescribed. Generally, cows are submitted to it when they have been tested in the same lactation period shortly after calving. If a cow on the strength of this first test, is entered in the Advanced Register, the results of the "eight months' test" are also entered.

TABLE I.

Country	Breeders' Association	Year of beginning of tests	Duration of tests	Extent of testing work
United States	Holstein–Friesian Breeders' Association.	1886	7 days 30 » or more 365 »	June 1912: 19 900 animals in *Advanced Register*; (including 1314 bulls).
	American Guernsey Cattle Club.	1900	365 days	Beginning of 1912: 1608 cows 124 bulls in *Advanced Register*.
	Ayrshire Breeders' Association.	1902	365 days	1912: 585 cows 298 bulls in *Advanced Register*.
	American Jersey Cattle Club.	1903	7 days 7-90 » 365 »	1911: 1100 cows 87 bulls in *Register of Merit*.
	Brown Swiss Breeders' Association.	?	365 days and shorter time	1912: 74 cows in *Register of Production*
Canada	Government undertakes superintendence of yield tests of animals of different breeds entered in herd books (see table II)	1905	365 days	May 1911: In *Canadian Record of Performance* are entered: Cows: 141 Ayrshires, 15 French Canadian's, 5 Guernseys, 156 Holstein-Friesians, 6 Jerseys. Bulls: 3 Ayrshire, 1 Holstein-Fricsian. A much larger numbcr of cows are being tested. (1912: There are nearly 500 cows in the *Rec. of Perf.*).
Germany	Allgäuer Herdbuchgesellschaft.	1894	Every fortnight a day's milk yield is tested	Tested 1894-1907: 2500 Herdbook cows. 2000 other cows. Under control, 1912: 486 Herdbook cows. 364 other cows.
	Div. Zuchtverbände in Bavaria.	1909		End of 1911: 4547 cows under control.

TABLE I (*Continued*).

Country	Breeders' Association	Year of beginning of tests	Duration of tests	Extent of testing work
Switzerland	Verband der Simmentaler Zuchtvereine.	1903	Usually every fortnight a day's milk yield is tested.	Concluded 1910: tests of about 60 cows; 413 full lactation periods.
	Verband der Freiburger Zuchtvereine.	1904		?
	Verband der Zuchtvereine im Canton Waadt.	1907		1911: 339 cows under control for at least 100 days.
Austria	Verband der Simmenthaler Züchter, Schärding.	1904		1912: 888 cows under control.
	Verband der Simmenthaler Züchter, Ried.	1910		1910: 73 cows under control.
	Mährische Herdbuchgenossenschaften.	?		1911: 1137 cows under control.
	Salzburger Zuchtgenossenschaften.	1910 (?)		1911: 1675 Pinzgau cows under control.
	Verband der Murbodner Viehzuchtgenossenschaften.	1910	One test every week	1912: 1632 cows under control.
	Montafoner Zuchtverband.	1911	?	?
France	Société d'élevage et de contrôle laitier du Normand-Caudois.	1908	Every 30 days a test of a days' milking	1910: 132 Herdbook cows and 56 other cows under control.

Cows can only be entered on the Advanced Register on having passed both the semi-official tests, if they have already passed an official one, and if, during their probation year (provided they began this at exactly 2 years of age), they have produced 250.5 lbs. of butter-fat. The amount of butter-fat increases $^1/_{10}$ lb. for every day that the cow is over 2 years of age at the time the tests were started, until the yield of butter amounts to 360 lbs. at the age of five years.

Bulls can be entered in the Advanced Register, provided they are the sires of at least 4 cows which have passed an official test.

The Secretary of the Association keeps a supplement to the Advanced Register in the form of a Blue book in which are inscribed the cows and bulls with *tested progeny*..

The Holstein-Friesian Breeders' Asociation offers annually about 15 000 dollars in prizes for cows giving the highest yields. The prizes are from 5 to 40 dollars each.

Since 1900, the American Guernsey Cattle Club has carried out annual tests of the milk and butter-fat yield of the Herdbook cows in a similar manner to that adopted by the Holstein-Friesian Breeders' Association. The nearest Agricultural College or Experiment Station, at the request of the club, appoints one of its officials as inspector ; he notes down on two days in every month the milk and butter-fat yield of the cow under test. The inspector furnishes the Agricultural Station to which he belongs with the results of each testing. On this report being examined and approved by the director of the Station, it is sent to the offices of the associations ; here the butter-fat yield is calculated from the milk yields sent in by the farmer and from the average monthly butter-fat content.

The milk given by a cow in 365 consecutive days is taken as the yearly yield. The testing can be begun at any time, on application being made to the Secretary of the Club and after payment of an entrance fee of 5 dollars, but usually the time selected is shortly after calving. The method of feeding is not prescribed ; but the owner must describe this in detail on forwarding his monthly report. The same cow may be re-tested. The expenses of the testing are paid by the owner.

Cows are entered in the Advanced Register of the Club on payment of a fee of 5 dollars, provided the animal's performance reaches, or exceeds, the required limits. The requirements are as follows :

Cows of 2 years old and under must give 6 000 lbs. of milk or 250.5 lbs. of butter-fat per annum. The required milk yield increases 3.65 lbs. for every day over the two years, till the cow is five years old, when the milk yield amounts to 10 000 lbs. In like manner, the required butter-fat yield rises daily $^1/_{10}$ lb. till at the end of 5 years it reaches 360 lbs.

There are two classes in the Advanced Register. For admittance to class A, the cow must score over 75 out of 100 points, in addition to

satisfying the above-mentioned requirements. The requirements for class B are confined to the milk and butter-fat record.

Herdbook bulls are entered in the Advanced Register on payment of 5 dollars, if at least two cows sired by them are already inscribed on this register. A bull is placed in class A if, in addition, it gets at least 80 points (out of 100), and in class B without inspection.

The American Ayrshire Breeders' Association has, since 1902, carried out similar annual tests of herdbook animals to those practised by the Guernsey Cattle Club.

The following annual yields are necessary for being placed on the Advanced Register.

a) Two-year-old form :

At least 6 000 lbs. of milk and 214.3 lbs. of butter-fat. The required yield of milk and of butter-fat increases daily 1.37 lbs. and 0.06 lbs. respectively for every day that the cow is over two years at the time of beginning the test.

b) Three-year-old form :

At least 6 500 lbs. of milk and 236 lbs. of butter-fat with the addition of double the amount required in class (*a*) for every day over three years.

c) Four-year old form :

7 500 lbs. of milk, 279 lbs. of butter fat.

d) Mature form :

8 500 lbs. of milk, 322 lbs. of butter-fat.

The conditions for bulls being entered in class *a* of the Advanced Register are the same as in the case of the Guernsey Cattle Club ; they are accepted in class *b*, if they have four daughters from different dams in the Advanced Register.

The cost of the test is shared equally by the owner and the Club. The registration fee for bulls and cows is 5 dollars.

The American Jersey Cattle Club opened in 1903 a Register of Merit for herdbook animals. It contains four classes for cows : AA, A, B, and C. To gain admission to class AA, a cow must have given a specified yield of milk and butter fat (see below) at an annual testing and scored at least 80 points ; she must, further, have given birth to a living calf during the testing period, and not less than 155 days after the beginning or more than 125 after the conclusion of the same. A cow is accepted in class A whether it has produced a calf or not, provided it has fulfilled the other conditions. For entrance into class B the cow need only have produced a prescribed amount of milk or butter-fat during a period of 365 days. Entrance into class C only necessitates the production of the required amount of milk or butter-fat during a test lasting 7 days.

The annual production of a cow to be entered in the Register of Merit is the same as that required by the Guernsey Cattle Club ; the necessary tests are also the same. The tester is obliged to confirm his statements by oath before a notary public, or a justice of the peace. During the seven days' test, each milking must be weighed and, in addition, one sample must be taken to determine the fat content of the milk. The lowest yield is 12 lbs. of butter-fat for a period of seven days ; it is 1 $^{7}/_{10}$ lb. per day for a period of 7 to 90 days. In addition to milk and butter-fat tests, there are also butter tests. Cows which are especially good producers receive prizes in the shape of gold, silver or bronze medals.

The test expenses are rather high. The tester may ask as much as 5 dollars a day and receives his travelling expenses in addition. This is all paid in the first instance by the owner of the cow, but when the latter is entered in the Register of Merit, the owner is repaid half his outlay from the funds of the Club.

Bulls are registered in class A of the Register if they have three daughters in the year's record out of three different dams, provided they score at least 80 points. They are admitted into class B under the same conditions, without scaling.

According to a notice in the Breeder's Gazette the Brown Swiss Breeders' Association have now also instituted tests of the yield of cows for breeding purposes.

In *Canada*, in 1905, several breeders' associations requested the Department of Agriculture to supervise the testing of cows of the various breeds. The result was that regulations as to the method of carrying out the tests were drawn up. According to these, the test must not last longer than 365 days. Only such breeders' associations will have their tests supervised as have conformed to the Government regulations. The cow should be entered on the test list before calving, but entries are received up to 30 days after calving. The owner is required to weigh each milking, and to forward a monthly report of the yield, feeding, and method of keeping the cow to the Government Live Stock Commissioner, using a special form for the purpose. The accuracy of his statement must be confirmed by oath. At least eight times during the testing, a Government inspector pays surprise visits to the farm and remains there two whole days for the purpose of controlling the milk yield and of taking samples of milk for the determination of the fat-content. The butter-fat yield is determined from the milk yield reports furnished by the owner and the results of the fat tests. The results are forwarded to the office of the Breeding Association to which the tested cow belongs.

The Government permits a cow which has been tested, to be entered in the Canadian Record of Performance, provided it has calved within 15 months of the time of testing, and if its yield equals, or exceeds, the a-

mount fixed for animals of its age. In the class for four-year-old and mature cows the lactation period previous to testing must not have commenced more than 15 months before the date of making the tests. The minimum yield for the several class is shown in table II.

TABLE II.

		Ayrshire	French Canadian Breed	Guernsey	Holstein-Friesian	Jersey
		lbs.	lbs.	lbs.	lbs.	lbs.
Class for two-year-old cows	Milk	5 500	4 400	5 000	7 500	5 500
	Butter-fat	198	198	200	255	218
Class for three-year-old cows	Milk	6 500	5 200	6 000	8 500	6 500
	Butter-fat	234	234	240	289	257
Class for four-year-old cows	Milk	7 500	6 000	7 000	9 500	7 500
	Butter-fat	270	270	280	323	297
Class for mature cows	Milk	8 500	6 800	8 000	10 500	8 500
	Butter-fat	306	306	320	357	337

Bulls which have 4 daughters by 4 different dams in the Record of Performance are also entered.

The owner of a cow which is being tested is required to provide the Government Inspector, during each of his visits to the farm, with free board and lodging and on his departure to send him to the railway station; otherwise the testing is free.

In *Germany* the "Allgäuer Herdbuchgesellschaft" has, since 1894, conducted milking tests and the determination of butter-fat content; these are carried out on two days each month during each lactation period of the cow. Cows which are not in the herdbook can also have their milk yield tested. The test-milking is superintended by persons deputed to take the samples and forward them to a dairy experiment station, where the specific gravity and fat content of the milk are ascertained and the content of dry matter free from fat determined (Fleischmann's method). The sample takers are superintended by a dairy inspector, who also keeps the register. The milk and fat produced by a cow from the tenth day af-

ter calving until the date when it again only gives 2 kg. (4.4lbs.) of milk, is regarded as the yield of one lactation period.

As a basis of comparison between the yields of the different cows the "fat unit" is made use of. This is ascertained by calculating the amount of the fat-free dry matter of the milk, taking a seventh part of the figure for the butterfat content and adding these amounts together. The explanation of this method of calculation is found in the fact that most of the milk produced is used in cheese-making. A determination of the fat-content alone would be insufficient for this purpose.

The results of the performance tests are entered in the Herdbook. On application, the owners of the cows tested can obtain "milk certificates."

In 1909, the Bavarian Government appointed a Dairy instructor, who introduced and superintended similar milk-yield tests in the case of other Live Stock associations. At the close of 1911, seven Live Stock Associations and 131 individual breeders, with a total of 4547 cows, took part in these tests, the expenses of which were borne by the Associations.

In Württemburg and Central Germany, various Live Stock Associations have for some time been carrying out milking-tests.

In *Switzerland* the "Verband der Grauviehzüchter" instituted so-called "Stierenmutterprüfungen" (tests of the dams of bulls) which were subsequently given up; but the "Verband der Simmentaler Züchter" in the autumn of 1903 began tests carried out as follows:

1) The milk yield of the cow during the whole lactation period was ascertained twice a month by a tester appointed by the Society, who at the same time determined the fat content and specific gravity of the milk.

2) The live weight of the animals was ascertained twice a year, and in certain cases also the increase during fattening and the carcase weight.

3) Records of the work performed by the cows were kept.

4) The points of the animals were judged and conclusions drawn as to their powers or work and their value to the butcher.

5) Their value for breeding was established by reference to herd books.

6) Accurate information was obtained as regards feeding.

The expense of the tests was defrayed by the Association. Every year about 60 animals were tested. The 5 years' period, at first prescribed for the testing, has been extended by a year and a half. Altogether, the test data are taken from 413 complete lactation periods. The cows received were scored (100 points scale) with regard to milk and meat production and work done.

On account of the difficulty of ascertaining the combined performance of the animal and the heavy expenses entailed thereby, these tests have also been discontinued, although their usefulness was recognized.

The " Verband der Freiburger Zuchtvereine " (Freiburg Breeders' Federation, dealing with the black-and-white breed) began similar performance tests in 1904. In addition, the " Verband der Zuchtvereine " (Breeders' Federation) in Canton Vaud (Switzerland), has carried out milking tests since 1907.

In *Austria*, the " Verband Simmenthaler Rindviehzüchter " (Simmenthal Breeders' Federation) in the Schärding district instituted milking tests in 1904 for pedigree and crossbred animals. The results were entered in the herdbook in the case of pedigree cows and referred to in judging the animals at shows. Pedigree cows which after their third calf, and cross-bred cows which after their second, yielded an annual average of less than 1 800 kg. (3960 lbs.) of milk are excluded from the testing.

Several Herdbook Societies in German Moravia have tests every fortnight for their cows. A grant from the Agricultural Council (" Landeskulturrats ") defrays the cost.

In 1910 the " Verband der Murbodner Viehzuchtgenossenschaften " (Federation of Murboden Cattle Associations) began regular milking-tests. The members weigh one day's milk yield every week with a registering scale (Lindemann's or Lederry's System), and an official of the Association comes every month to the owners to determine the milk and butter-fat yield (Gerber's method). He enters his own observations, as well as those of the owner of the cow, in a " Milk book " and reckons up the monthly yield of milk and butter-fat. In spring and autumn, the weight of the cow is calculated from measurements taken with a special measuring-tape (Gewichtsmessband). From the report in question, it is not clear whether only cows entered in the herdbook take part in these performance tests. Some details are given as to the food to be fed to the cows. It should be mentioned that the Federation receives a large grant from the State.

The " Zuchtverband für Pinzgauer Vieh " (Pinzgauer Cattle Breeders' Federation) instituted milking tests in 1911.

In *France*, the " Société d'élevage et de contrôle laitier du Normand-Cauchois " (Normand-Cauchois Breeders' and Milk-testing Society) was founded in 1907 ; since 1908 it has carried out milking tests. Cows are entered in the Association's herdbook under the following conditions :

1) They must have a well-bred appearance (the details of the points required can be omitted here).

2) They must give a specified amount of milk and butter. This in the case of cows which at the commencement of the testing have still one milk tooth, is 2 600 kg. (5 720 lbs.) of milk and 109 kg. (240 lbs.) of butter in the 300 days following calving. Full-mouthed cows must yield

3 200 kg. (7 040 lbs.) of milk and 138 kg. (303½ lbs.) of butter during the same length of time.

Bulls can be entered in the herdbook only if they are the offspring of registered cows.

The milking tests are made 10 times in the 300 days by a tester belonging to the Society ; and are restricted to the milk yield of 24 hours each time. The tester on the day of inspection weighs each milking and takes a sample of it, the fat content of the sample being determined in an Agricultural Experiment Station. From the results of the testings on the 10 control days the total butter-fat yield is estimated ; this figure multiplied by 1.12 is taken as being the yield of butter.

The cost of the test is met by the owner of the animal and amounts to 6 fr. (4*s.* 9*d.*) per annum for herdbook cows, and 8fr. (6*s.* 4*d.*) for cows not entered in the Herdbook. The tester receives free board and lodging from the owner during each control day. He must also be taken on to the next farm, provided it is not more than 16 km. (10 miles) away. Lately, there has also been an attempt to settle the amount of food to be given to the cows.

In *New Zealand* the Department of Agriculture is about to undertake the superintendence of the performance tests of herdbook cows on the same lines as those adopted by the Canadian Government.

In *Australia*, the government of *Victoria* has decided to introduce official control of milking-tests for pure-bred cows.

Although the methods of work of these different societies show many differences (1) they are similar in certain respects :

1) The animals of a farm are scarcely ever *all* tested.

2) The amount of food required to produce 1 lb. of milk or butter-fat is not given.

3) The results of the test are usually entered in the Herdbook, or a special register (Advanced Register, etc.).

4) Bulls are also often entered on this register, if they have sired daughters whose milking qualities are good, or if they are the offspring of good milkers.

It is thus seen that this work is undertaken by cattle breeders who wish to select the best milk or butter producers in their herds ; by *breeding* from these animals they obtain an increase of the families in which these characters are prominent with the expectation of increasing the production.

(1) The European Herdbook Associations carry out their milk tests in nearly the same manner as the Cow-testing Associations.

B. — The Performance Tests of the Cow-Testing Associations.

1. *Origin and Spread of Cow-Testing Associations.* — In Denmark, N. J. Fjord tried by means of private feeding experiments to determine the effect of different food substances upon the milk yield. His experiments, begun in 1865, aroused much interest, and therefore he soon received assistance both from the Danish Agricultural Society, and also from the State. The latter first afforded pecuniary assistance to the investigator and subsequently provided him (in 1888) with buildings for carrying on the work ("Laboratoriums for Landökonomiske Forsög").

The experiments were carried out on larger specially selected farms according to a uniform plan. Three similar lots of at least 10 cows were selected and given the same rations for a preliminary period (1 to 2 months); this ration, however, contained the two substances to be tested, *viz.* oil cake and grain, in equal proportions. In the following principal period of the experiment (one to two months) one lot of cows was given *only* oil cake in the ration, which otherwise remained unchanged, while the other received *only* the other food substance (grain); the quantity fed of both was double that given during the preliminary period. The ration of the third lot remained unchanged. During the closing period of the experiment, all the cows received the same food, which when possible, contained the same ingredients as the rations given during the first period. Throughout the whole time of the experiment, the yield of milk and butter-fat for each cow was determined.

If the milk yield was equal during the preliminary period, different during the principal period, and again equal during the last, it was concluded that this difference in the milk yield was due to the change in the feeding. If the experiments of the following year confirmed these results, the feeding value of the substances tested was determined by taking the average results of all the experiments. Feeding experiments of this kind are at the present time also carried out under the direction of the above-mentioned laboratory.

It was soon found that the food given to the cows made little difference to the fat content of the milk (1), and that some cows regularly give a milk with a high percentage of fat, while that of others is poor in this substance. Experiments begun in 1880, then showed that the property of yielding milk of a high fat content could be transmitted by cows to their offspring. This gave an impetus to instituting milk and butter-fat yield tests in prac-

(1) Later experiments have proved that certain food substances increase the fat content of the milk to some degree. See: *Berichte über Landwirtschaft vom Reichsamt des Innern*, Heft 24, Berlin 1911.

tical agriculture. The Dairy Advisor Hansen began carrying out such tests on his own cows and, by weeding out unsatisfactory animals from the herd, succeeded in increasing the total milk and butter-fat yield.

At the instigation of Mrs. Hansen, the first "Cow-Testing Association" was established for the purpose of making regular tests of the milk yield. The management of the Association was undertaken by a Committee consisting of several members. Important questions were decided by the General Assembly. The tests were carried out by a "Control assistant" appointed by the society, whose duties were to determine every fortnight, by means of weighing, the daily milk yield and food consumption of each cow in the herds belonging to the members. Further, he was required to investigate a sample of the milk of each cow on testing days and thus to determine the milk and butter yield of each cow, as well as its rations for each control period. At the end of the year, he was required to prepare a kind of balance sheet in which the rations of the cow were placed opposite the milk and butter yield. It was considered immaterial whether the cow had calved or not during the time in question. The results obtained were not entered in the Herdbook. It was hoped that by eliminating all unsatisfactory milch cows from the herd, not only would the net receipts be increased, but the milk-yielding capacity of the whole breed would also gradually improve.

New societies very quickly arose in Denmark with the same object in view; in 1909, their number had already reached 128. Milk control societies are soon to be started also in the neighbouring countries, and they also exist, not only in many European countries, but also in America and New Zealand. A summary is given in table III.

2. *Organization and Methods of Working.* — The organization of most of the European Cow-testing Associations is very similar to that of their Danish model. The number of members depends upon the frequency of the milk tests; if these are made twice a month, the Association cannot have more than 13 or 14 members, as otherwise one control assistant would not be sufficient for the work. In the case of less frequent tests, the number of members can be increased. The Associations of Canada, New Zealand, Ireland and Argentina differ essentially from the others in having no control assistant.

The milking-test is usually carried out at intervals of 14 days in European countries, sometimes (in Scotland and also elsewhere) the interval is increased to three weeks, while some societies only have the day's milk yield of their cows determined every 4 weeks. In some Finnish Associations, it is customary for the owner of the cow himself to undertake the milking test on two days in the month and the control assistant on one.

After each test, the control assistant usually determines the fat content from samples which he takes at the time of weighing the milk. For

TABLE III.

COUNTRY	Date of foundation of the Assoc.n	Recent condition of Cow-Testing Associations				Breeds taking part in tests
		Year	No. of Societies	No. of members	N. of cows.	
Denmark	1895	1911	521	11 776	207 491	Almost all red Danish dairy cattle.
Germany (North and Centre)	1897	1912	493 (1)	about 7 100	over 200 000	Different breeds, mostly lowland cattle.
Sweden	1898	1911	over 700	9 000 to 10 000	225 000 to 250 000	Black-and-white lowland breed in South; Ayrshire and red-spotted Swedish dairy cattle in Centre; Fjäll breed in North.
Norway	1899	1912	149 (2)	3 384	39 905	?
Holland	Before 1900	1910	244 (3)	?	over 77 000	?
Finland	1901	1909	73	881	17 024	Native breeds, Ayrshires, crossbreds.
Russia	1903	1912	abont 200 (4)	abont 2 700	83 000 to 84 000	Native breeds, East Friesian, Schwytzer, Angler, Fünen, Kholmogorie and Jaroslav.
Great Britain: Scotland	1904	1911	18	about 300	about 12 000	Chiefly Ayrshires.
Austria	1904	1911	?	about 1 000	about 13 000	Different breeds, including 3412 black spotted lowland-cows, about 2500 Simmentalers, 822 of the grey breed.
United States	1905	1912	85 (5)	—	45 000	?
Canada	1906	1910	167	1 143	11 850	?
New Zealand	1909	1910	4 (6)	?	?	?
Hungary	1910	1911	5	41	3 188	Simmental, Hungarian spotted cattle, crossbreds
Ireland	1911	1911	12	163	1 425	Mostly cross-bred Shorthorns, some of them pure-bred.
Argentina	1911	1912	2 (7)	?	?	?

(1) Including 12 independent of the Agricultural Chambers and Agric. Centres.
(2) Including 35 with extended activities *viz.* accounts for cattle rearing (Fjosregnskapsforeninger).
(3) Including 133 «folkvereenigingen» (Cattle Breeding Associations) which, besides milk records, keep a herdbook and have a bull in common.
(4) 70 in the Baltic Provinces, 80 in Poland, 50 in the other Governments.
(5) According to the *Breeder's Gazette* (Chicago. Feb. 14, 1912). The official returns for 1910 give 59.
(6) A number of other associations have recently been formed, and the records of 20 000 cows will probably be tabulated in the coming season (See *Journal of the New Zealand Department of Agriculture*. 15th. August, 1912, pp. 143-144)
(7) It is hoped to bring up their number to 45 in 1912.

fat determination, the Gerber or the Lindström apparatus is used, the latter especially in Sweden. In many Norwegian Societies, a regular control of the milk yield alone, without fat determination, is carried out.

The North American milk control societies, as a rule, only have one test a month, *i. e.* determine one day's milk yield. As in Europe, the tester (control assistant) spends each time one day on the farm and carries out the usual operations. The Babcock apparatus is used for fat determination.

In Canada, each member of a Cow-testing Association possesses the necessary apparatus for test milking — spring balance, sample dipper, glass flasks and sample-boxes for the latter, as well as the required forms, and himself carries out the test milking at least three days a month, entering the details upon the special form. Each sample taken is placed in a glass flask bearing the number of the particular cow and, at the end of the month, all are sent to the nearest dairy or cheese-factory for the fat determination. Some preserving medium is added to prevent the milk turning.

The Cow-testing Associtions of Ireland, New Zealand and Argentina have adopted the Canadian system. In Germany, this method is also used in isolated cases.

The Cow-testing Associations in Europe (1) (with the exception of those in Ireland and many in Austria), and those in the United States have the food ration of each cow usually weighed by the control assistant each milk-testing day and the food used by the animal during the period is thus calculated.

When the cows are at pasture evidently only an estimate can be made. In Germany, the usual practice is to reckon an equal amount for all the cows at grass as " maintenance ration " and to add to this the consumption of " productive ration ". The latter is reckoned higher for cows in full milk and for heavy milkers than for those giving less milk. Another system is also in use, in which the amount of pasture consumed by the cow is calculated from the amount of winter food it required.

In Canada, the estimation of the quantity of food for each cow is not the regular work of Cow-Testing Associations, but the Government provides the farmer with forms, which give information on the subject of feeding and serve for the calculation of the amount of food used. These forms are much used. Many farmers have also adopted the practice of feeding cows with concentrated foods in amounts varying according to their yield of butter fat.

(1) The material to hand gives no information as to the usual practice in Holland.

In Ireland, New Zealand and Argentina the amount of the rations is not estimated.

The data obtained by the control assistant on the control days assist him in calculating the annual yield and the food consumption of each cow and of every herd belonging to the Associations.

Of the absolute yields, in addition to the percentage of butter-fat content, either the milk yield alone (Scotland), or the milk and butter yield (Denmark, Sweden, Norway, and Germany in part), or the milk and butter-fat yield (in parts of Germany, Ireland, the United States and Canada) are reckoned.

To estimate the yield in proportion to the food consumed, the latter is referred to units. The term " Food Unit " has been adopted in Denmark and the idea is based on the experiments of Fjord. A food unit consists of 1 Danish pound (1.10 lb.) of mixed grain; the values of other foods in relation to this are taken as follows: oil-cakes, equal; mangels and kohl-rabi, $^1/_9$ to $^1/_{10}$; turnips $^1/_{12}$; hay, $^2/_5$; straw $^1/_5$. The amount of milk and butter given by each cow per food unit and the money value of the products are then calculated.

In Sweden the food unit is also employed in calculation, but it differs from the Danish one; the weight is expressed in kilograms (1 kg. = 2.2 lbs.), and further a food may be estimated higher or lower according to its quality. The experiments of Fjord are also the first principles of the Swedish food estimation; experiments of the Swedish " Centralanstaltens Husdjursafdelning " have given further material.

Table IV shows the valuation of feeds in the Swedish system.

TABLE IV.

A " food unit " consists of:	Average in kg.	Limits in kg.
Earthnut cake	0.8	0.75–0.9
Cotton cake (decorticated)	0.8	0.8–0.9
Cotton cake (slightly decorticated)	0.9	0.9–1.2
Cotton cake (undecorticated)	1.5	1.2–1.5
Soy cake and meal	0.85	0.8–0.9
Sunflower and linseed cakes	0.9	0.8–1
Gluten food	0.95	0.8–1.2
Nut cakes	1.0	—
Peas, vetches, field-beans	1.0	0.9–1.1
Maize	1.0	0.9–1.1
Wheat, rye, barley	1.0	1.0–1.1
Mixed summer grain (half barley, half oats)	1.1	1.1–1.2
Oats	1.1	1.1–1.3
Sugar beet slices	1.1	1.1–1.2
Wheat and rye bran	1.2	1.1–1.3

	Average in kg.	Limits in kg.
Hay	2.5	2–3
Summer cereal straw	4.0	3.5–4.5
Winter cereal straw	5.0	4–6
Potatoes, wet brewers' grains	5.0	4–6
Red clover, lucerne, meadow grass	8	6–1.0
Beet-slice silage (1 kg. dry matter)	10.0	8.–12
Tares and oats (green)	10.0	8–12
Mangolds, kohl-rabi, carrots	10.0	8–12
Turnips	12.5	10–15
Beet leaves	15.0	12–18
Potato-pulp (1.2 kg. dry matter)	12.0	10–14
Full milk	3.0	—
Skim milk	6.0	—
Whey	12 0	—

As in Denmark, the yield of each cow in milk and butter, together with the money value of these products is reckoned per 100 food units.

In the German Cow-testing Associations, the amount of food used is expressed in Kellner's starch values (1) (as well as the protein-content). From this can be calculated the amount of butter-fat and butter given by a cow per 100 starch values; the amount of milk and butter produced per 100 food units; or the food cost entailed in the production of 100 kg. of milk with 1% fat or in the production of 1 kg. of butter-fat.

In Ireland, the Swedish system is most in use. In Norway, 1 kg. of good hay is a food unit; the total number of food units is calculated, not the products to be obtained by 100 food units.

Some of the Russian Associations have adopted the estimation from starch values (and protein content) but the material at our disposal does not permit of a conclusion as to whether this method has been generally adopted.

The first Austrian Cow-testing Association has decided for calculating according to the money value. Some of the Associations which have been founded most recently only carry out milk-testing, without concerning themselves with the amount of food consumption.

The Scottish Milk Record Committee reckons the amount of food used according to its money value, but in the Report for 1910, the daily cost of food per cow belonging to the different Societies alone is given, and the food cost per gallon of milk (both for natural milk and milk reckoned at 1 per cent. of fat). The food consumption of each cow is not mentioned. In the Report for 1911 the data respecting food consumption are omitted.

(1) A starch value is to a Swedish food unit as 1 to 0.605. This ratio however is somewhat variable in the case of several food stuffs.

In an extract in our possession taken from the report of the first Cow-testing Association of the United States the food costs per lb. of butter-fat and per 100 lbs. of milk are given (1).

In Canada, Ireland, New Zealand and Argentina the consumption of food per unit weight of the milk or butter produced is not reckoned.

The question has often been asked as to whether test milkings carried out from time to time are a sufficient basis on which to estimate a cow's performance. B. Martiny gives some interesting details on this subject in the *Deutsche Landwirtschaftsgesellschaft*: *Arbeiten N.* 211. In the testing of three milking-machines, the milk yield of 24 cows during 75 days was accurately ascertained, and the fat content of the milk was also determined. In order to test the accuracy of test milking carried out on one day every week, the amount of milk reckoned to be produced every day for 7 days was compared with that actually obtained. The largest discrepancies were —7.35 per cent. and + 5.35 per cent. Martiny says that if the greatest error limit is ± 6, and supposing it to occur over the whole year (which is not deducible from this 11 week's experiment), a cow whose yearly milk yield had been calculated from weekly tests as 2400 kg. might give actually 6% (= 144 kg.) more or less, *i. e.* 2256 or 2544 kg. of milk. The true butter-fat yield would thus differ considerably from the estimate ob tained, according to these experiments.

Experiments made at the Minnesota Experiment Station show less error limits. They were carried on for nine years and the methods of calculation were as follows : 1). Determination of one day's milk yield each month, simultaneous fat determination and calculation of the milk and butter-fat yield for half a month before and after the date of the test milking (method of the American Cow-Testing Associations). 2). Weighing of 8 milkings in the middle of each month and determination of the fat content in a mixed milk sample. 3) As 2), but from four milkings. 4). Calculation of the yield of a three weeks' period from the record of one day

(1) We have just received an interesting Bulletin (No. 226) from the Agricultural Experiment Station of the University of Wisconsin dealing with a Dairy Cow Competition. This competition began on Nov. 1, 1909 and was continued until Oct. 31, 1911 ; 506 cows competed (Holstein-Friesians, Guernseys, Jerseys. and also a few cross-bred cows). Tests were made according to the system adopted for annual tests by the American Breeding Associations. (See III A).

The feed costs are calculated per cow and the yield per 100 « feed-units » consumed.

Prizes are given for the best producers of a total value of about 5 000 dollars, half of which is given in money.

The best herd, consisting of 10 Holstein cows, produced an average of 16 044.4 lbs. of milk per cow in 365 days and 589.695 lbs. of butter fat.

in the middle of the period. 5) Calculation of the yield of a fortnight from the record of one day in the middle of the period. The sum of the total results for all periods was, in every case, added together and compared with the actual yield.

In Table V the greatest variations observed in any experiment year are given, as well as the average variations.

According to these determinations, the difference between the calculated yield and the actual yield is so slight, even in the case of milking tests made only once a month, that in practice it will not lead to erroneous conclusions as to the performance of a milch cow.

The food consumption of a single animal is certainly more difficult to determine than the milk and butter-fat yields, as it depends ultimately on estimates either of the money value, or of the number of food units or starch values consumed. For even if the price of the food could be exactly ascertained, it would be scarcely possible to estimate accurately the amount of food consumed by each cow. Nevertheless, such a calculation is a matter of some importance. The results are not intended to show whether this or that Cow-Testing Association, or country, obtains milk, etc., at the cheapest rate, but to indicate to the owner, which cows in his herd are economically good, or bad or medium. Though mathematical precision cannot be attained by these means, still many valuable practical hints can be obtained.

That the food consumption varies in proportion to the milk and butter-fat production in the case of different cows and that it is of importance to ascertain it, is shown by an exact experiment carried out by Eckles and Reed on two Jersey cows at the Missouri Experiment Station. These animals, which were half-sisters, showed a great difference in their milk and butter-fat production during their first two lactation periods. It was resolved to determine the cause of this.

The two cows calved for the third time within three days of one another. They received during the whole of the third lactation period exactly the same food, which was given in amounts to maintain their weight, which was nearly equal, as far as possible the same during the whole period. Neither was put to the bull. The food consumed and the milk yield and composition were accurately determined. At the time of the highest milk yield a 10 days' digestion trial was interpolated, and at the close of the lactation period, both cows were put for three months on maintenance rations.

If the food consumption and the milk and butter-fat yield of the poor milker (No. 62) is represented by 1, the food consumption of the deep milker (No. 27) is 1.75, the milk yield 2.67 and the butter-fat yield 2.77. The absolute milk yield of No. 27 was 8522 lbs. and the butter-fat yield 469.9 lbs.

TABLE V.

	MILK					BUTTER-FAT				
	Method of calculation					Method of calculation				
	1	2	3	4	5	1	2	3	4	5
Cow. No. 1	%	%	%	%	%	%	%	%	%	%
Greatest difference	— 3,3	— 2,5	+ 3,1	— 2,7	— 1,6	+ 2,8	+ 3,2	+ 3,6	— 4,6	— 1,9
Average difference	— 0,9	— 0,6	— 0,8	— 0,5	— 0,6	+ 0,3	— 0,8	— 0,7	— 0,8	— 1,2
Cow. No. 2										
Greatest difference	+ 2,1	— 2,3	— 2,3	— 2,9	— 1,7	+ 2,9	+ 3,5	+ 3,9	+ 5,6	— 3,1
Average difference	— 0,8	— 0,9	— 0,8	— 1,0	— 0,8	— 0,8	± 0,0	+ 0,6	+ 0,3	— 1,8
Cow. No. 3										
Greatest difference	— 4,9	— 3,2	— 3,8	— 2,3	— 2,7	+ 2,9	— 3,8	— 3,9	+ 5,7	— 3,9
Average difference	— 0,8	— 0,9	— 0,8	— 0,3	— 1,5	— 1,1	— 1,4	— 0,6	— 0,4	— 2,7
Cow. No. 4										
Greatest difference	+ 2,6	— 1,9	— 2,6	— 2,6	— 3,3	— 4,2	— 4,3	— 5,3	+ 4,4	— 4,8
Average difference	— 0,1	— 0,4	— 0,5	— 0,5	— 1,9	— 0,2	— 0,5	— 0,7	+ 0,7	— 2,7
Cow. No. 5										
Greatest difference	— 3,7	— 0,9	— 2,8	— 3,8	— 5,2	— 5,1	+ 2,9	+ 4,4	— 3,2	— 3,0
Average difference	— 1,2	— 0,3	— 1,0	— 1,3	— 1,6	± 0,0	— 0,4	— 1,1	— 0,4	— 1,2
Cow. No. 6										
Greatest difference	— 3,9	— 3,3	— 3,8	— 4,5	— 1,8	— 4,8	+ 3,5	— 3,9	+ 4,3	— 1,6
Average difference	— 1,1	— 0,9	— 1,1	± 0,0	— 0,3	— 0,6	— 0,5	— 0,5	+ 1,2	— 1,4
Cow. No. 7										
Greatest difference	— 4,3	— 4,0	— 4,5	— 3,8	— 2,0	— 4,5	— 3,3	— 6,1	— 5,1	— 2,7
Average difference	— 2,0	— 1,2	— 1,8	— 0,6	— 1,3	— 1,7	— 0,9	— 1,3	— 0,7	— 1,5

The digestion experiment showed that the two animals digested the food given them about equally well (digestion coefficients 64.99 and 64.39 per cent.).

They also required practically equal maintenance rations, No. 27 needing only slightly more than No 62.

The difference in performance is thus not due to difference in digestive capacity, nor in need of more maintenance food, but must depend on the fact that No. 27 ate and digested actually more food then No 62 and that it used this extra food in milk production.

3. *Recent Development of Cow-testing Associations.* — The Danish, Swedish and German Cow-testing Associations have, with few exceptions, united into provincial Unions. In Scotland, all the Control Societies have formed a central Committee. In the Russian Baltic Provinces Control Unions have also been formed. (1)

These unions have a joint system of book-keeping. They draw up the necessary control measures together and, as a rule, also publish the results of their work.

The Canadian Government has established " Dairy Record Centres " for the Cow-testing Associations : the head official of each centre superintends the control work. He gives information on dairy subjects when required. In addition, he has to estimate the milk, butter and cheese production of his district.

In Denmark many Cow-testing Associations have begun to extend their control work to rearing young cattle and to other branches of breeding and even field crops ; they have become book-keeping associations. The same has occurred in Sweden where the control of cattle and pig breeding are included by many Associations. The food consumption of the animals on one side and the increase in live weight or progeny on the other are accurately determined. (The pig food is reckoned by " barley units "). The activities of the Norwegian Associations for the Control of Cattle-Keeping are likewise extended to all branches of animal breeding.

The Swedish Herdbook Societies enter into their herdbooks the performance data supplied to them by the Cow-testing Associations. Some local Breeding Societies in Denmark and Germany have begun entering the performance of their cows in the herdbooks.

The two large Herdbook Associations in Holland (Neederlandsch and Friesch Rundveestamboeck) have expressed their willingness to cooperate with the " Fokverecnigingen " (see Table III), if the latter will accept the conditions laid down by the Herdbook Societies. At the present time,

(1) From the material at hand, it is not clear whether such unions also exist in other countries than the above-mentioned.

27 " Fokvereenigingen " have affiliated themselves to the Dutch " Rundveestamboek " and 4 to the Frisian. Cows belonging to the affiliated Associations can be entered in one or other Herdbook, if they are eligible as to points and have a certificate as to their milk production.

Bulls, in addition to points, have to furnish a certificate concerning the milk and butter-fat production of the dam, and if possible also of the grandam.

In 1911, the Department of Agriculture for Ireland determined to establish a Register of Dairy Cattle in which pure-bred milch cows and cross-bred Shorthorns are to be entered. Before a cow can be registered, it has to be examined at the local cattle show. If its points are satisfactory, it must further be tested for its milk and butter-fat yield (Canadian system). Further,it may only be served by milk bulls of its own breed. If a registered cow has calved, this fact, together with a full description of the calf, is to be communicated within 7 days to the Department. Bull calves from these cows may be selected for registration in the Milk Register, and are accepted definitely if they win a prize later under the conditions prescribed by the Government.

The Danish law of June 8 1912 (1) provides that bulls of a milk breed may take prizes at the Shows of the Agricultural Societies two years after the coming into effect of the said law, and at the State Shows three years after that date, only if there is a trustworthy certificate concerning the milk yield and milk-fat yield of their dams. After the lapse of five years from the coming into effect of this law, no cow of a milk breed will receive a prize without certificate of milk yield. The Minister of Agriculture can, under certain conditions, grant exemption from these rules.

At the Shows at Malmöhus (Sweden) cows of the black-and-white breed can only win prizes if their annual milk production is at least 3500 kg. (7700 lbs.) or their butter yield 110 kg. (242lbs.). The milk production of the dam will be taken into account in judging bulls at shows.

The German Agricultural Society so far does not require at its annual shows a certificate of the performances of the cow, though it is sometimes presented. For demonstration purposes, cows with such certificates are often placed in groups. In some provincial exhibitions in the Rhine province, Schleswig-Holstein, and East Friesland, the performance of the cow has been considered in prize-giving.

In proportion as the data of the work of the Associations are useful also to the breeder, it is necessary that some guarantee should exist that the results obtained can be relied upon ; thus the superintendence of the control assistant and of the whole work of the Association is desirable. This

(1) See above, No. 1383. (*Ed.*).

superintendence is exercised in Denmark by the "Cattle Breeding Advisors" in addition to their other work. In Sweden, the Unions appoint Head Assistants for this purpose. The Norwegian Associations are under the superintendence of travelling agricultural instructors. In Germany, some Unions employ Head Assistants or similar officials; but the superintendence, when it exists, is usually exercised by members of the Agricultural Chambers, etc. The Dutch Herdbook societies entrust the superintendence of the affiliated "Fokvereenigingen" to their officials. In Ireland, the Department of Agriculture keeps the inspection of the Associations in its own hands. As to the inspection in other countries not mentioned above, either information is lacking or a short reference is given in another place.

The rapid development of Cow-testing Associations has made special courses of instruction necessary for the training of a sufficient number of Control Assistants. Such courses are held in Denmark, Sweden, Norway, Germany and Finland (Holland?). They last four to six weeks (in Finland ten weeks), and are intended for young farmers who have finished their studies at a Farm School. In Denmark and Finland, however, farmers' daughters are often trained for Control Assistants and practise as such.

4. *The Cost and State Support of the Work of Control Societies.* — The cost of the work of the Cow-testing Association in the case of the Danish system, consists in the expense incurred in purchasing the necessary apparatus (centrifugal machine with butyrometers, thermometer, etc, and scale), which amounts to about $100 (£20), and the salary of the control assistants (on an average $ 150 or £ 30; in Finland $ 60 to $ 160 or £ 12 to £ 32; in the United States about $400 or £80) to include the cost of reagents, books, etc. The annual expense works out at about $ 0.50 to 1.20 (2*s.* to 5*s*) per cow. To this must be added the free board and lodging which the control assistant receives wherever he may be working at the time.

The expenses of the Canadian system are far less, as no control assistant is required.

In almost all countries, the Cow-testing Associations receive more or less support, either from the Government or the Agricultural Associations, or both together.

According to the law cited above Denmark devotes an annual sum of 120 000 crowns ($ 32 000 or £ 6 600) to the support of the Associations.

In Sweden, each Association receives a subsidy from the State of 200 crowns ($ 53 or £ 11), and during the first four years, each member who possesses less than 25 cows receives a State grant of 50 öre (13 cents or 7*d.*) per cow annually. In the Northern provinces, this contribution is extended for four years more in the case of members with less than 10 cows. The State support is conditional upon the Provincial Agricultural Society in question also promising a grant of at least as large a sum.

The Norwegian Associations receive an annual State subsidy of 200 crowns ($ 53 or £ 11), if they determine also the butter-fat content, otherwise they only receive 150 crowns ($ 40 or £ 8 5*s*.). The "Fjosregnskabsforeninger" (Cattle Raising and Book-keeping societies) each receive 250 crowns ($ 67 or £ 13 15*s*) annually.

In Germany, the Provincial Agricultural Chambers or Agricultural Central Offices give, as a rule, a foundation grant to newly established Cow-testing Associations. Some Agricultural Chambers also grant annual subsidies. Further, they often undertake the expense of training the control assistants.

In 1910, Holland gave out of the State funds 19687 florins ($ 7914 or £ 1626 4*s*.) for the expenses of bull-keeping societies, Cow-testing Associations, and the "Fokvereenigingen".

In Finland, each Association received from the Local Agricultural Societies a yearly additional grant of $ 30 to 60 (£ 6 to 12).

In Austria, the work of milking tests receives much assistance from the Government or Agricultural Societies. The exact sum given, however, cannot yet be stated.

In Hungary in 1911, each .Cow-testing Association receives an annual State grant of 2000 crowns ($ 405 or £ 83). This sum is, however, only paid in the early years, in order to assist the farmers in establishing Associations. It is contemplated giving a smaller subsequent grant. The Agricultural Ministry has drawn up a specimen Statute for the Associations.

The Highland and Agricultural Society of Scotland has hitherto given £ 200 ($ 975) for the support of the Scottish Milk Record Societies. The Ayrshire Herdbook Society also gave £ 40 ($ 95) and at the beginning of this year, the Government granted £ 1000 ($ 4866) annually for the support and extension of the work of the Milk Record Societies. (1)

The Department of Agriculture for Ireland supplies the necessary forms and books gratis to the Societies. In a limited number of cases, a penny (2 cents) per cow per month is given.

The Dairy Department of the Ministry of Agriculture in the United States works conjointly with the Governments of the different States for the extension of the work of Cow-testing Associations. It provides recently started ones with forms and books, which are drawn up on one plan. It further assists in their establishment ; this is often also done by the Governments of the several States. The latter also in many cases superintend the work of the Associations.

(1) See the *Dairy World*, London, January 16, 1912.

The Canadian Government provides the Associations with tablets for the preservation of milk samples and sulphuric acid for fat determination ; this is in addition to the necessary forms (see above). It also pays the expenses of the fat determination, which is carried out by the managers of the dairies. The " Dairy Record Centres " have been mentioned already.

The Department of Agriculture of New Zealand has instituted, together with the " Dalefield Dairy Company ", Cow-testing Associations. It supplies them with the forms gratis on condition of their forwarding an annual report.

The Argentine Associations owe their foundation also partly to the Government. The latter works in cooperation with the " River Plate Dairy Company " at their extension. The R. P. Dairy Company has hitherto bor e the greater part of the expense of the foundation of the Associations and defrays the cost of the fat determination. The Agricultural Department provides the necessary books and superintends the work. The town of Buenos Ayres, in order to make milking tests more popular, has offered an annual prize of 100 pesos ($ 96.60 or £ 19 6*s.* 8*d*). for the cow with the highest milk and fat yield, and another of the same amount for the best Dairy Farm.

(The question whether the milk yield can be increased by breeding, and if so, how this object can be attained, will be discussed in a supplementary article, which will appear in our November number).

1440 – A Comparison between the Milking of Dairy Cows Twice and Three Times a Day.

78de Beretning fra den Kgl. Veterinaer og Landbohöiskoles Laboratorium for landökonomiske Forsög. — *Communicated by the Bureau of Denmark of the International Institute of Agriculture.*

The Experiment Laboratory, in the above work, carried out on its customary method, supplies a contribution to the vexed question of the advisability of milking two or three times a day. The experiments were practised with cows in groups of like composition, some of them being milked twice and others three times a day. Comparative trials of the character in question cannot be prolonged for more than six months, as when the cows get heavy in calf the uniformity of the groups is lost. Although, owing to this, the results of the laboratory experiment cannot lay claim to entire reliability, they nevertheless deserve to be recorded.

The actual trial period was preceded by a preparatory period, the object of which was to select from the stock on the farms where the experiment took place, enough newly-calved cows to form the required uniform

groups with at least ten animals in each group. In the preparatory period the cows selected for the experiment were milked an equal number of times (two or three respectively) according to the farm. In the period of experiment which followed, one group was milked twice a day and one group three times a day. Then during the course of this experimental time the two groups were changed, so that those previously milked twice were milked three times and vice versa. In this way it was sought to determine whether the additional yield ascertained on milking three times was really due to the fact of milking or to any deficiency of agreement between the groups. The experimental period was followed by an after-period in which the groups were once more milked the same number of times.

With two milkings, the interval between the milkings was in most cases 12 hours. With three milkings it was endeavoured as far as possible to get an interval of 8 hours, though as a rule this was not feasible for practical reasons. The milking times, averaging all the trials, were as folows :

4 a.m.
10.45 a.m.
6 p.m.

The trials were altogether carried out with seven double groups. Group A was milked twice a day and Group B three times a day. The following figures found as the average of all groups may enable a judgment to be arrived at as to the uniformity of groups A and B at the time when they were formed.

	Group A	Group B
Daily milk yield of 10 cows on formation of the group	354.9 lbs.	354.5 lbs.
Daily diminution per 10 cows in the preparatory period	18.25 lbs.	17.4 lbs.
Daily butter-fat yield per cow on formation of group	1.113 lb.	1.124 lb.
Average weight per cow	1034 lbs.	1034 lbs.
Increase of weight per cow during 10 days preparatory period	0.2 lb	1.8 lb.
Average interval between calving and beginning of trial period in days	79	80
Average age in years	6.7	6.3

The table show an exact concordance between the groups, which is for that matter true not only as regards the average of all trials, but likewise of the individual trials themselves. Importance can hardly be attached to the small differences.

As a proof of the fat-content of the milk with the different daily milkings there are given below the percentages of fat ascertained partly by Gerber's apparatus on the farms themselves and partly in the laboratory by chemical analysis. The following double columns comprise on the one hand the whole of the seven trials except the concluding period,

when one farm dropped out, and on the other hand three further trials of the total number which lasted longer than the remainder and in which the milking times for the groups were charged during the trial period.

	7 (6) Trials		3 Trials	
	A	*B*	*A*	*B*
	%	%	%	%
Preparatory period	3.14	3.15	3.22	3.22
Trial period	3.16	3.15	(1) 3.22 (2) 3.16	(1) 3.15 (2) 3 22
Concluding period	3.32	3.35	3.28	3.31

(1) In 2 milking times.
(2) „ 3 „ „

From these figures it is evident that the fat-content of the milk of the groups tallied almost exactly during the preparatory period ; the difference was only 0.1 %. While group B showed a slight excess weight in the preparatory period, the case was reversed during the trial period. In the concluding period, when the groups were milked the same number of times, group B once more showed a somewhat higher content of fat in the milk than group A. This occurrence is certainly pure chance, but on the other hand it points clearly enough to the fact that milking three times a day does not yield milk richer in fat than twice a day. The evidence of the figures for the three trials is the same. The determinations of total solids do not suggest that more frequent milking produces any noteworthy changes in the amount of total solids in the milk.

The *milk yield* of the several groups will be seen from the folllowing table :

	Milk yield of the groups:			
	7 (6) Trials		3 Trials	
Daily milk yield of 10 cows in lbs :	*A*	*B*	*A*	*B*
Preparatory period	352.1	351 6	351.0	350.8
Trial period — Number of days	86	86	42	42
Trial period — Milking twice a day	298.1	—	306.4	277.1
Trial period — Milking three times a day	—	315.9	289.2	318.6
Concluding period	259.7	264.3	278.0	279.5

From these figures it is seen that in the preparatory period the groups yielded nearly equal quantities and that the cows at the beginning of the trial period averaged a daily yield of something over 35 lbs.; they were therefore really good milkers. For the trial period the following average figures resulted :

Daily milk yield of 10 *cows in lbs*:

	Milking twice	Milking three times
7 (6) experiments	298.1	315.9
3 experiments	277.1	289.2

As the average figures for the milk yield of the groups in the concluding period lie fairly close to each other, it may be concluded that the difference ascertained during the trial period milking 3 times a day as compared with the preparatory period, is to be attributed to the more frequent milking.

The outcome of this is that with cows which yielded 28 to 30 lbs. of milk a day, milking three times produces an extra yield of 1 3/4 lb. per cow as compared with the animals milked twice. Nevertheless from these experiments of brief duration no correct judgment can be formed as to the influence which more frequent milking exerts on the development of the milk productiveness of the cow. One is readily inclined to assume such an influence, particularly if the three milkings are practised on young cows. There is probably ground for the assumption that the extra yield from the three milkings a day is to some extent dependent on the arrangement of the milking times, that is to say, that an increasing yield may be anticipated according as the interval between the milkings approaches nearer to 8 hours. The experiments carried out furnish points of fact in support of this assumption. Though the extra yield was not so large as is usually counted on in practice, the report of the experiments ascribes this to the fact that in practice, when changing over to three milkings a day the food ration is at the same time increased as a rule, and therefore a portion of the extra yield must be put down to this increased food supply.

In order to elucidate whether the 2 or 3 daily milkings in any way affected the gain in weight of the cow, weighings were practised regularly. The results are given below in the form of the average of the whole 7 (6) trials.

Daily gain in weight of 10 *cows in lbs*:

	A	B
Preparatory period	+ 0.2	+ 2.0
Experiment period	+ 2.2	+ 1.5
Concluding period	+11.2	+ 9.5

It is seen from this that the gain in weight of the groups does not quite tally during the preparatory period. Group B in that period seems to show a much greater tendency to put on weight than group A, a condition of things which must be borne in mind in order to form a correct appreciation of the results in the trial period. In point of fact, in the trial period there was a much greater agreement in the gain of live weight by both groups, and group B, which was milked 3 times a day during the trial period, apparently put on weight nearly as well as group A, notwithstand-

ing the higher milk production. In reality, however, this was not the case, because, on the strength of what has been said above, it must be supposed that group B posessed by nature a greater tendency to put on weight than group A. In the concluding period, in which the two groups were once more milked the same number of times, the same difference between the groups as in the preparatory period recurs. Altogether, the more frequent milking reduced the weight of the cows, but to no very great extent.

The question of the influence exerted by the food ration, the milk-producing capacity of the cow and the difference in the trial period, on the extra yield with three milkings per day, is also investigated in the present report. The material in the shape of figures is however so slight here that no particular value can be attached to the results secured.

The report of the experiment concludes with the following remarks: It really affords ground for much surprise that the cows in the group milked three times a day during the trial period did not, despite the larger milk production, lose very much more weight than those groups milked twice a day. Even if we disregard the experiments in which the feeding of the animals was specially plentiful, we nevertheless do not find in the remaining groups with three milkings during the trial period any such loss of weight as compared with the two-milkings group as would be supposed in consequence of the larger milk output. The cause cannot be stated with certainty, but possibly the results of the trials at *Bregentved* (60th. Report of the Laboratory) may afford some guidance. These experiments proved that a cow, the food of which contained more nitrogen than she needs, *i. e.* was above the nitrogen minimum, eliminated the excess in its excretions, expecially the urine. In proportion as the excess nitrogen gradually diminished, the elimination of nitrogen in the urine fell off. The idea therefore readily suggested itself that the cows in the above-named trials, in which the food supply was pretty large and the quantity of albumen above the minimum, were able to use a part of the excess nitrogen for the larger quantity of milk obtained by the three milkings. The excess yield with three milkings a day was 1 3/4 lb. of milk per cow, and taking a basis of 3 per cent. as the protein contents of the milk, which corresponds to 0.5 per cent. of nitrogen, the group milked three times a day only needed to eliminate 4 gr. of nitrogen less per day in the urine to have the same quantities of nitrogen available for milk production as a cow in the group which, with the same feeding and two milkings, yields a less quantity of milk.

1441 - Report on the first Egg-Laying Competition at Burnley, April 1 1911 to March 31 1912. POULTRY

HAWKINS, H. V.: in *The Journal of the Department of Agriculture of Victoria, Australia*, Vol. X, Part 7, pp. 430-442. Melbourne, Victoria, July 1912.

At the Burnley Egg-Laying Competition the following breeds were represented: 46 pens of White Leghorns, 7 of Black Orpingtons, 4 of Silver Wyandottes, 3 of Minorcas, 2 of Golden Wyandottes and 1 each of Brown Leghorns, White Orpingtons, White Wyandottes and Faverolles, altogether 66 pens of 6 birds each. During the year 12 hens died. The greatest number of eggs laid was 1566 by one pen of White Leghorns, but the report mentions that this breed is more difficult to handle than many of the heavier types, owing to the considerable amount of inbreedingl that has been going on for some time; whilst the system of housing in smals sheds the whole year round has a tendency to soften the birds. If thig breed is to maintain its high reputation a more natural way of keepine them must be adopted in order to favour a better development of fram work with plenty of stamina.

The Orpingtons were very satisfactory. No trouble was experienced with their health, and the average gross return per hen was somewhat better than with the White Leghorns.

The Wyandottes came next, and especially during the cold weather they produced good results.

Each lot was placed in a pen 30 feet by 12. The pens were separated by plain sheet iron 3 feet high and this was surmounted by wire netting 4 feet high. Each pen had a galvanized iron fowl house, on the floor of which 6 inches of sand were strewn.

The weather conditions were on the whole favourable.

The food was given three times a day. In the morning a hot mash was fed consisting of 20 lbs. pollard, 6 lbs. oat-bran, 4 lbs. lucerne-chaff which was scalded over night. To this was added 25 lbs. of boiled bullock's liver finely chopped, the whole being well mixed together. Every pen received approximately 15 oz. of this mash. Two or three times a week 10 per cent. of raw onion was added. At midday green feed of different kinds was given. Whilst in the cold wet weather a small quantity of mash made of pollard and wheat bran was added. The evening meal was composed of a grain mixture: 4 parts wheat, 3 parts broken maize, and 2 parts of short oats. The allowance to each pen was about 12½ oz. In the warm weather some variations were made, and occasionally when a pen would become sluggish in appetite the ration was reduced until their avidity for food returned.

Hens showing signs of broodiness were enclosed in a small netting wire coop, which was left in their own yard. By this system it was found that the hens returned to egg production within seven to eight days.

The following table gives a summary of the results obtained.

Number of birds	396
Total number of eggs laid	73 325
Market value of the eggs	£319 11*s.* 7¼*d.*
Cost of feed	£128 6*s.* 2*d.*
Profit over feeding	£191 5*s.* 5¼*d.*
Greatest number of eggs laid per pen	1566
Average number of eggs per pen	1110.9
Average number of eggs per hen	185.1

The paper is accompanied by a table which gives the number of eggs laid by each pen for each month and for the whole year as well as the weights of the eggs.

1442 – The Egg Trade in the United States.

Diplomatic and Consular Reports. — United States: Report for the Year 1911 *on the Trade and Commerce of the Consular District of Philadelphia.* Annual Series, No. 4892, p. 6. London, 1912.

The exportation of eggs from the United States in 1911 was, notwithstanding the high prices, the largest hitherto recorded. The number of eggs sent abroad from the United States in the year ending 31st. December 1911 was 13 250 000 dozen, representing a value of $2 750 000 (£550 000), while the highest figure in any previous year was 8 250 000 dozen of a value of $1 750 000 (£350 000) in 1907. Further in 1907 about 150 000 dozen were exported to Hawaii and Porto Rico.

The egg trade has undergone noteworthy changes during the last few years. At one time there were large imports and limited exports. The imports in each of the years 1884, 1885 and 1886 exceeded 16 000 000 dozen, as against an exportation of about 250 000 dozen. The reduction in the importation of eggs took place immediately after the coming into operation of the 1890 customs tariff, and the imports, which had risen to 16 000 000 dozen and had exceeded 15 000 000 dozen in 1890, fell off, while the exports increased, as shown in the following table:

Imports		Exports	
Year	Dozen of Eggs	Year	Dozen of Eggs
1892	4 000 000	1880	80 000
1894	1 750 000	1890	380 000
1896	less than 1 000 000	1897	1 330 000
1899	250 000	1900	6 000 000
1910	800 000	1907	8 400 000
1911	1 500 000	1911	13 250 000

Cuba, Canada, Panama and Mexico are the principal countries importing from the United States. The quantity exported to Cuba in the fis-

cal year 1911 was about 4 500 000 dozen of a value of about $1 000 000; to Canada 2 500 000 dozen of a value of about $ 500 000; to Panama a little over 750 000 dozen; to Mexico about the same. The remaining quantity was sent chiefly to the West Indies and the States of Central America; exports to Europe were practically nil.

Of the eggs imported into the United States in 1911 1 250 000 dozen came from the United Kingdom and 250 000 dozen from China and Hong-Kong. These figures however do not include egg yolks, of which, in the fiscal year ended on the 30th. June 1911, there were imported into the United States from Canada 350 000 lbs. and from Germany 75 000 lbs.

1443 - **The Bee-visited Flora of the First Province of Farther Calabria.** BEES

POLSONI, ALFREDO.: La flora apistica della Calabria Ulteriore I. — *Le Stazioni sperimentali agrarie italiane*, Vol. XLV, Part 7, pp. 476-500. Modena, 1912.

According to G. De Layens about one fifth of the plants growing in Europe are visited by bees. The Labiatæ and Leguminosæ in particular supply a large contingent of nectar-bearing species. Nevertheless the apicultural importance of one and the same species varies from region to region, being affected among other things by the area over which the plant is cultivated. Thus, in Sicily and Calabria, among the best melliferous plants citrus trees are noted; in Lombardy heather and buckwheat; in the Marches *Hedysarum coronarium* and sainfoin, only because these plants are most cultivated in the regions in question. An ideal bee plant should be constantly visited by the bees, should supply abundant honey of good quality, have rich and prolonged flowering, and be serviceable for other uses likewise. These criteria have served for the guidance of the author in his compilation of the present catalogue of bee plants in the province of Reggio Calabria. He has availed himself both of the experience of various authors and of his own observations. The number of species listed by him up to now is 157, in addition to the varieties (as against 198 recorded by Savastano for the Naples province and 357 enumerated by Hommel). Amog the exotic bee plants the author recommends in particular the introduction of those flowering in summer.

The species are grouped and arranged in families; there is given the scientific name, the Italian name or names and the dialect names if any; some botanical information on the natural occurrence, flowering of the plant, nature of the soil, and habitat; particulars regarding the importance of the plant for bees, that is to say whether it is nectar-bearing or polliniferous, whether more or less frequented by bees, of what quality the honey yielded, etc. After the catalogue is found an alphabetical index of the genera and the most common Italian and dialect names of all the bee plants enumerated, together with a short bibliography.

SILKWORMS

1444 - Report on the Methods to be Employed for Increasing Cocoon Production,

LAMBERT, F.:Rapport sur les moyens à employer pour augmenter la production des cocons. — *Bulletin mensuel de l'Office de Renseignements agricoles*, Year XI, No. 7, pp. 878-897. Paris, July 1912.

M. Lambert, Director of the Silkworm Station at Montpellier, gives in the following table a summary of the silkworm production and its factors in France from 1852 to 1910.

Years or periods of years	Number of breeders	Number of ounces (of 25 gr.) put to hatch	Production in fresh cocoons	Yield per ounce of 25 gr.	Price per kilogram of cocoons
			kg.	kg.	fr.
1852	162 777	584 559	12 062 542	20.63	4.62
1872	200 538	809 581	9 871 116	12.02	6.00
1878–1885 . . .	158 243	316 285	7 936 215	25.05	3.85
1886–1890	139 653	256 889	8 319 273	32.05	3.75
1891–1895	144 933	228 204	8 747 216	39.02	3.23
1896–1900	133 235	198 826	8 029 134	40.22	2.87
1901–1905	126 454	191 807	7 511 948	39.32	3.03
1906–1910	120 732	183 127	7 428 442	40.44	3 47

This table shows that the number of silkworm breeders and the amount of eggs hatched is diminishing, while the yield of cocoons per ounce of eggs, on the contrary, is increasing, having nearly doubled since 1852. The price obtained for cocoons has remained nearly the same as it was half a century ago, in spite of the competition of the Far East, varying from 3 to 4 fr. per kg. In fact it is found that there is only a difference of 31 centimes between the price in the period 1846 to 1853 and that obtained to-day, and if the increase in the State premium granted to breeders is added to the latter, the difference is actually in favour of the present rate.

The figures given in the preceding table show that the decrease in the cocoon production is due to two causes operating together : a decrease in the number of breeders and of the eggs to be hatched. This is shown still more clearly by the following table :

Periods	Decrease		Proportion of amount of eggs (in ounces of 25 gr.) to number of breeders
	in No. of breeders %	in amount of eggs %	
1852 — 1885	4	46	4.0
1886 — 1890	12	19	2.0
1891 — 1895	0*	12	1.5
1896 — 1900	9	13	1.5
1901 — 1905	6	4	1.5
1906 — 1910	4	6	1.5

* Increase of 3 % on the preceding period.

This comparative study shows that :

1) The decrease in production is due, from 1852 to 1890, entirely, or chiefly, to the decrease in the number of eggs (*i. e* the cessation of breeding on a large scale); after that date, it is caused by the diminution in the number of breeders ; as since 1890 there have been no large silkworm raisers, the fault lies in the reduced number of silkworm breeders on a small scale.

2) From 1900, the number of eggs hatched by each breeder can be regarded as having reached its lowest level ; thus, the decrease in the quantity of eggs corresponds exactly, or nearly so, with that in the number of breeders.

Contrary to the generally received opinion, the cause of silkworm breeding on a large scale having been abandoned, is not a great fall in the sale price of cocoons, since the present prices are much the same as those of 50 years ago ; neither can it be explained by the increased cost of labour, for this is more than made up by the higher yields, which have more than doubled during the last 50 years.

" The real causes of the decline in the industry on a large scale and the consequent decrease in the quantity of eggs hatched are two: the first is the idea that this kind of breeding is doomed to failure, the second, and the more important, being the favour in which vine-growing is held (and which is, at present, justified) by agriculturists, which causes them to abandon all less paying industries, not only the cultivation of the mulberry tree, but also of the olive.

" The idea that large breeding establishments are always unsuccessful and cannot yield profits at the present time is without foundation and is, moreover, contradicted by experience. To ensure their being always profitable is, no doubt, more difficult than to succeed in breeding on a scale of some grams, but it is possible. Further, there are means of letting these large establishments enjoy the advantages of the smaller ones. This can be effected by : 1) the subdivision of the large trays into small ones of three ounces at most, each intrusted to a special attendant ; 2) rearing by means of the system of profit-sharing practised by many large owners in Italy and by all the silkworm-egg producers in France and Italy."

It is thanks to this excellent system that the average yields in the silk-rearing provinces (Pyrénées Orientales, Var, Basses-Alpes and Hautes-Alpes) amount to over 60 kg. per ounce of 25 gr. This system, if it were extended, would be also a good method of training breeders.

But the chief cause of the desertion of sericulture on the part of large farmers is due to the great attraction which exclusive vine-growing possesses for them. This industry is the most paying of all, in good seasons ; but the system of monoculture constitutes a permanent danger. There are technical and economic reasons for introducing more variety in the crops, in view of preventing the crises to which vine-growing has been subjected during the last 50 years. The technical reasons are the inconveniences entailed eventually by the permanent cultivation of large crops of the same plant on the same soil ; the economic grounds are the ever-threatening dangers connected with over-production.

Lack of technical skill has been the cause of small breeders giving up silkworm keeping : this could be remedied by training skilled breeders.

From the above considerations the writer concludes :

" *A*. The best way to remove the causes of the decrease in the number of silkworm eggs hatched and in that of the breeders on the one hand, and to develop cocoon production on the other, is the development of instruction in sericulture where it exists, and where it is absent, the promotion of the teaching of this industry in agricultural schools, primary schools and elsewhere, with the triple object of : 1) Reconstructing the large breeding establishments by showing that they can now, more than ever, be made lucrative ; 2) discouraging monoculture by means of insisting continually and at length upon the technical and economic dangers of this disastrous system, and the certain evils resulting from it (unfortunately, examples will not be lacking to serve as illustrations to this theme) ; 3) finally, the training of efficient breeders, in the schools, by means of courses, conferences, and practical work, such as rearing silkworms and cultivating the mulberry-tree ; and outside the schools, by the help of fixed or travelling demonstration silkworm nurseries, and experiment plots for teaching the cultivation and manuring of the mulberry and its pruning

" To this suggestion others may be added, *e. g.* the following:

" *B.* The formation by the nation, the departments, or the communes of plantations of mulberry trees along the lines of communication (roads, railroads, cross roads, etc.), on the banks of canals (both those for navigation and irrigation) and of rivers, and in public places, such as promenades (utilizing for this purpose barren varieties), in the courts and gardens of schools, etc.

" *C.* Encouragement in different ways: the free distribution of mulberry trees, exemption or reduction of taxes on newly planted ground, and especially silk-worm nursery and mulberry culture competitions, which are much appreciated by agriculturists and which yield excellent results.

" *D.* The encouragement of the extension of the culture of the mulberry and of silkworm-rearing beyond the limits of the districts where they are now practised, by means of the above-mentioned methods, and with the addition of public conferences, which might influence persons who, so far, have not tried silkworm breeding. Small quantities of eggs might also be distributed.

" *E.* The creation of a central service of sericulture, or at least a sericulture inspectorate authorized to carry out simultaneously all the different measures for combating the causes of the decrease in cocoon production, and with power to develop the industry, both as regards extent and intensity, everywhere where it is possible to practise it conjointly with vine growing."

1445 – Indian Silks.

Burmese Silks. — *The Indian Agriculturist*, Vol. XXXVII. No. 7, pp. 223-224. Calcutta, July 1, 1912.

Silks from India — *Bulletin of the Imperial Institute*, Vol X, No. 2, pp. 212-214. London, July 1912.

Notwithstanding the almost general use of silk garments by the Burmese, the cultivation and manufacture of silk have not been a financial success. The industry might be more widely practised in Burma but an obstacle to it is formed by the Buddhist faith of the population; raw silk therefore is mostly imported from China and Japan. Small quantities are, however, produced in the province. The method of working is as follows:

The silk, which is of a dull yellow colour, is boiled in water about six hours until it becomes white. While still moist, it is spun on to wooden wheels. After drawing it is dyed by boiling for an hour in a bath containing an alkaline soap and aniline dyes. It is then dried in the sun and reeled again; next it is unravelled onto a hexagonal frame (rya) from which it is passed to the hand loom.

Chinese raw silk ("mypah") is in skeins, twelve of which form a bundle and fifteen bundles a load, weighing from 126 to 132 lbs. It is of a dirty yellow colour, which turns to white after boiling, in which operation it loses one-fourth of its weight. This silk is worth 25*s.* to 30*s.* per viss (3.65 lbs.) before boiling, and up to 37*s.* 6*d.* after boiling.

A "paso" 9 yds. long and 14 to 22 in. wide takes a man about five days to weave. A paso of 9 yds. is worth from 10*s.* 6*d.* to 17*s.* 6*d.*

Burmese silk is much coarser and heavier than Chinese and Japanese. From these countries principally there was imported into Burma during 1910 raw and manufactured silk to a value of £197 000 and £64 000 respectively.

The following is the result of examinations of Indian silks carried out at the Imperial Institute in London.

	No. 1	No. 2	No. 3
Moisture in material as received, on drying at 105° C., *per cent*	9.1	9.8	9.7
Loss in weight on "boiling off" with a neutral soap-solution (on dry weight), *per cent*	20.7	18.8	25.7
Diameter of raw silk thread as received	0.0012 to 0.0029 in.	0.0022 to 0.0045 in.	0.0015 to 0.0029 in.
Mostly about	0.0015 to 0.0020 in.		0.0022in.
Diameter of brin (single filament)	0.0003 to 0.00055 in.	0.00025 to 0.00045 in.	0.0003 to 0.0005 in.
Average	0.00043 in.	0.00033 in.	0.00037 in.

Sample No. 1 came from Mirganj, Eastern Bengal; the thread contained 8 baves (cocoon strands); the silk was of the type of Bengal "Surdah" and "Rose-filature," but not nearly so carefully reeled. It was valued (November 1910) at 11*s.* per lb. in the United Kingdom.

Sample No. 2 came from Assam. The thread had about 20 baves with very varying diameter (18 to 34 deniers); the silk was of inferior quality, unsuitable for general manufacturing purposes, and was valued (November 1910) at not more than 8*s.* per lb.

These samples, although of somewhat low value, show a promise of future success if more modern methods of reeling are introduced and if the local industry is organised and developed as has been the case in Kashmir.

Sample No. 3 came from Bangalore, Mysore. Thread contained about 11 baves. This silk, representing the Bangalore type, was better than ordinary Bengal silks, but inferior to Chinese and Japanese; it was of fairly regular size (16 to 20 deniers on the average), more adapted for

weft than for warp. Probable value (June 1911) about 13*s.* 6*d.* per lb. in the United Kingdom. (1)

1446 - Production of Mulberry Leaf and Cocoons in Italy.

Produzione della foglia di gelso e dei bozzoli in Italia. — *Bollettino di Sericoltura*, Year XIX, No. 31, p. 311. Milan, August 3, 1912.

The Office of Agricultural Statistics of the General Direction of Statistics and Labour, publishes the following returns:

REGIONS	PRODUCTION					
	Triennial average 1909-1911		1911		1912 Approximate estimate	
	Leaf	Cocoons	Leaf	Cocoons	Leaf	Cocoons
	tons	tons	tons	tons	tons	tons
Piedmont	150 000	6 270	158 000	5 900	163 300	5 630
Liguria	6 100	295	6 200	305	3 940	197
Lombardy	400 200	16 450	367 000	14 500	357 450	16 550
Venetia	353 000	10 000	236 700	8 740	267 200	10 275
Emilia	74 110	3 090	66 000	2 390	56 100	2 215
Tuscany	48 800	2 530	57 750	2 360	38 280	2 010
Marches	34 550	1 550	28 250	1 410	24 100	994
Umbria	8 750	490	7 000	325	6 400	335
Latium	1 375	49	1 280	49	985	49
Abruzzi and Molise	2 350	128	2 260	118	2 260	118
Campania	5 800	265	4 630	344	5 400	264
Calabria	46 650	1 400	51 000	1 380	41 500	1 000
Sicily	4 900	167	3 840	148	2 460	118
Total (1)	1 038 000	42 700	990 000	37 970	969 400	39 760

(1) The total in the first column does not agree with the sum of the figures for each province in the original from which these figures are calculated. (*Ed.*).

(1) In the administrative year ended March 31, 1911, raw and manufactured silk was imported into India to the value of Rs. 3 61 69 026; the exports of raw silk and cocoons were Rs. 50 55 287, and of manufactured silk Rs. 7 69 003. (*The Statesman's Yearbook for* 1912, p. 146. London, 1912). (*Ed.*).

The production of the mulberry leaf in the present year is found to be somewhat less than that in 1911, owing to the late frosts which occasioned notable damage in some regions. In return, however, the breeding of silkworms has everywhere been favoured by the course of the season, so that the quantity of cocoons obtained in 1912 exceeds that of 1911. In comparison with the previous year, therefore, there was a larger yield relatively to the quantity of eggs put into incubation. To this circumstance alone is due the increased crop this year as against 1911, because the tendency to reduce breeding is taking more pronounced form, owing to the successive declines in the price of cocoons. The following are the figures of production divided over the regions:

1447 - Production of Cocoons in Roumania in 1911.

Sericulture in Roumania in 1911 (Cresterea viermilor de matase). — *Câmpul*, Year XI, No. 8, p. 224. Bukharest, July-August 1912.

Returns prepared for 1911 by Leonida Colescu, Director General of State Statistics.

Number of localities where silkworms were reared		1 786
Number of rearers		34 651
Quantity of eggs hatched:		
Supplied by the Ministry of Agriculture	48 085 gr.	200 197 gr.
Supplied by the Spinners' Society	55 885 „	
Produced by the breeders	96 227 „	
Crop of cocoons		190 993 349 kg.

As a general average 1 gr. of silkworm eggs produced, in 1911, 935 gr. of cocoons, as against 1083 in 1910; 1238 in 1909; 1047 in 1908; and 1140 in 1907. The results of rearing were good in 5951 cases; mediocre in 15 360; and poor or nil in 13 340. The maximum crop of cocoons was secured in 1907: 436 057 kg. obtained from 382 840 gr. of silkworm eggs.

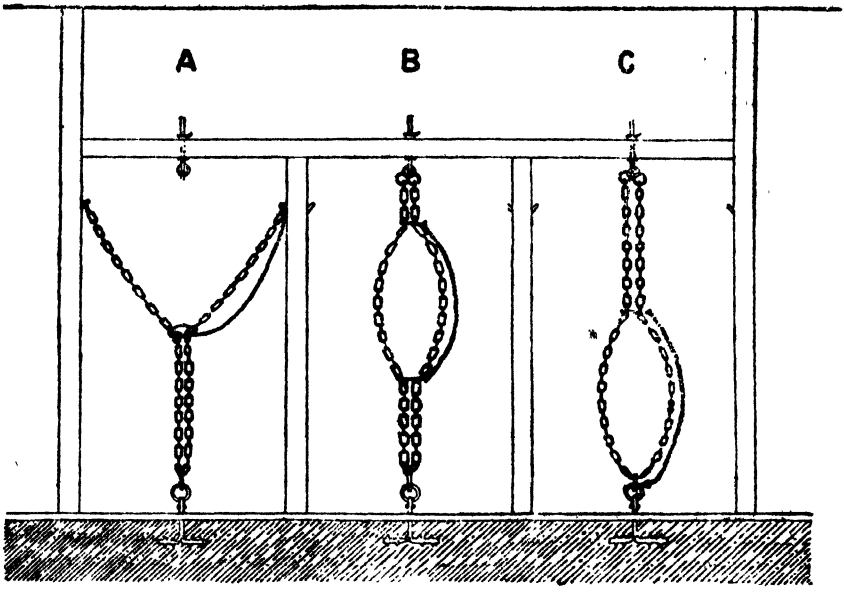
FARM ENGINEERING.

BUILDING-CONSTRUCTION

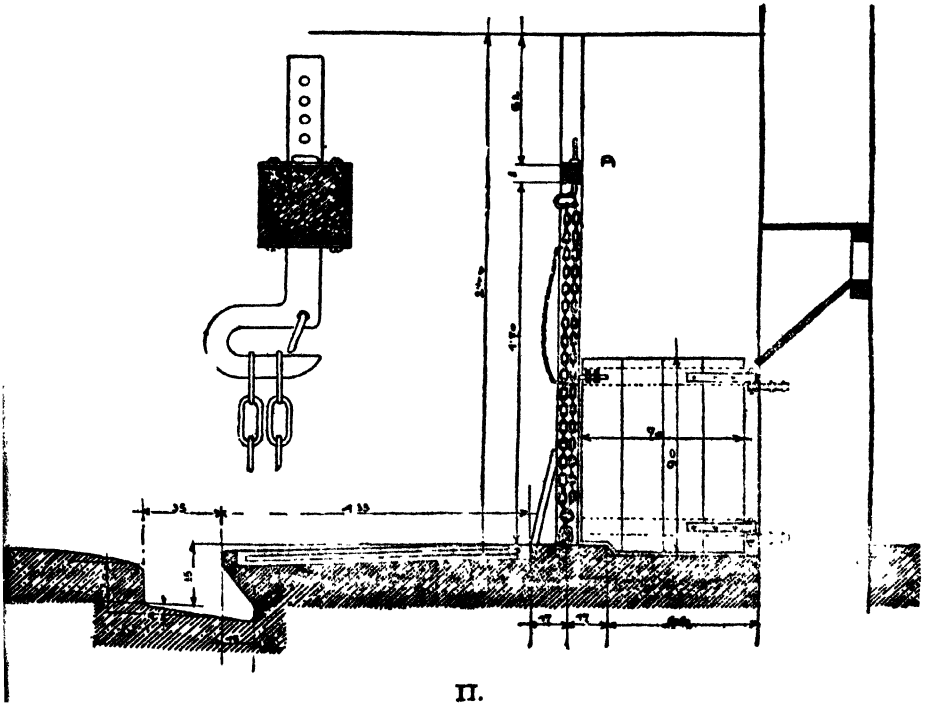
1448 - A Chain for Tying Cattle, used at the Austrian School of Alpine Economy.

EGGER, OSWALD.: Die "Grabnerhängkette" der Oesterreichischen Landesschule für Alpwirtschaft. — *Tiroler Landwirtschaftliche Blätter*, 31st. Year, No. 15. pp. 276-279. Innsbruck, August 1, 1912.

The illustrations show a new kind of chain for tying cattle. The chains are fastened below to a ring which is secured to a staple in the floor of the stable (see Fig. I). In this figure, A shows an open chain, B a chain when the animal is standing and C when it is lying down. In figure II there is shown in detail on the left the hook into which both ends of the chain



I.



II.

are hung above. Figure II also shows an arrangement of stalls suitable for the chain ; the standing room is just enough to allow a cow to stand ; the dung falls into the gutter behind. No feeding trough is provided; in its place there is a small depression in the ground. The figure also exhibits a partition movable after the manner of a door, which can be fitted between every two cows when they are to be fed individually according to their yield.

The chief advantage of the device is that the animals can lie down very comfortably and do not get dirt on their coats. It is not so easy for them to collide with each other as with ordinary chains. The feeding place can be very easily cleaned.

In the Austrian Provincial School of Alpine Economy where the new device has been introduced it is found very satisfactory.

RURAL ECONOMICS.

RURAL ECONOMICS

1449 - **The Cultivation of Land in the Netherlands and a Description of the Agricultural Regions.**

Het Grondgebruik in Nederland, gevolgd door eene Beschrijving der Landbouwgebieden — *Department van Landbouw, Nyverheid en Handel. Verslagen en Mededeelingen van de Directie van den Landbouw.* 1912, No. 3 s'-Gravenhage.

The statistics of the uses to which land is put in Holland are of comparatively recent date. The first information which is at all reliable dates from the middle of the seventies, but has no claim to being complete. It merely gives the number of cow keepers possessing at least 6 milch cows and that of the farmers with 1, 2, 3 and 4 or more horses, divided according to owners and tenants. In 1879, the material collected was first worked up into a summary of the conditions obtaining over the whole country. In that year, the number of cowkeepers with at least 6 milch cows and of farmers possessing at least 1 horse was 83 522, of whom 68 per cent. were freeholders and 32 per cent. tenants. For the next three years, the statistics give the following figures:

	1880	1881	1882
Total number of cowkeepers with at least 6 cows and of farmers possessing at least 1 horse	83 597	85 364	83 439
Freeholders	57 490	55 827	54 714
Tenants	26 107	29 537	28 725
Percentage of freeholders	68	65	66

In the mean time, in 1881 an attempt was made to obtain statistics as to the number of owners and tenants possessing 1 hectare (2.47 acres) or more of land, as well of the areas cultivated by these groups. The data from 1888 on can be regarded as being reliable. In addition, the above-

mentioned statistics regarding cow keepers and farmers were extended, although they were discontinued in 1903, when the Reorganization of Agricultural Statistics was carried out, and thus appear for the last time in the Agricultural Statistics of 1900. (The data for 1901 and 1902 were not published). At the same time, it was determined that cultivation statistics should be drawn up at intervals of several years. Thus, since 1904 no statistics of the employment of land have been published, and the first complete data relating to this subject were collected in May and June 1910, at the same time as the cattle census was taken ; the volume in question affords information respecting the results of these agricultural statistics.

Cultivators were divided into the following four classes :

Class I : Chief occupation agriculture (farmers and cattle breeders). Only properties of 1 hectare (2.47 acres) and over are mentioned, it being considered that the owner of less than 1 hectare can hardly derive his chief income from it.

Class II : Chief occupation gardening (gardeners). The lowest limit in this case is an area of 5 ares (20 poles or $^1/_8$ acre).

Class III : Labourers, whose chief occupation is to work for hire in agricultural, horticultural or forest holdings ; but who at the same time cultivate for themselves at least 5 ares ($^1/_8$ acre) of land.

Class IV : Persons having a chief occupation other than agriculture or horticulture ; provided the area they cultivate is at least 1 hectare (2.47 acres).

The results of the census are given in the report for each agricultural district, each province and each group of agricultural regions throughout the whole country, and are drawn up in 8 special tables. The total number of farmers of all four classes mentioned in the census is 275 890, divided as follows :

Farmers, gardeners, labourers and persons whose principal occupation is not agriculture or gardening but who possess at least 1 hectare of land	209 156
Gardeners with 0.05 to 1 ha. of land	4 710
Labourers with 0.05 to 1 ha. of land	62 024
Total . . .	275 890

These 275 890 persons have altogether under cultivation 1 934 839 ha. (4 781 099 acres) of arable, pasture and garden land, 908 639 ha. (2 245 300 ac.) being freehold and 1 026 200 ha. (2 535 799 ac.) being rented.

According to the data obtained by the mayors for the purposes of agricultural statistics by means other than the exclusive addition of the

figures given, the land used for arable, pasture and gardening purposes in the Netherlands in 1910 was as follows :

Arable land	867 274 ha.	2 143 084 ac.
Pasture land	1 210 431 ha.	2 991 045 ac.
Gardens	76 661 ha.	189 434 ac.
Total	2 154 366 ha.	5 323 563 ac.

This large difference of 219 527 ha. (542 464 ac.) is shown in the report to be due to various causes. It suffices here to mention in passing that the discrepancy between the two returns is especially large in those provinces where there are great expenses of grass-land, which do not belong to agricultural undertakings. In the following table the properties of 1 hectare and over are divided into 6 classes for the whole country.

Class	Percentage of Each Class in the total of the properties	Percentage of Each Class in the properties with an area of 1 ha. and over
1 to 5 ha.	52.40	13 47
5 to 10 ha.	19.81	15.04
10 to 20 ha.	14.74	22.33
20 to 50 ha.	11.38	36.78
50 to 100 ha.	1.57	10 58
100 ha. and over	0.10	1.80
Total	100	100

This table shows that more than half, 52.40 per cent., of the properties are smaller than 5 ha. (12⅓ acres), while there are only 0.10 per cent. which have an extent of 100 ha. (247 ac.) or more. The picture is far otherwise if the proportion which each class bears to the total area is considered.

The different agricultural regions, and thus the single provinces, show very different characteristics, as the following table clearly sets forth.

Percentage of each size of property in areas of 1 hectare and over, divided according to the 6 agricultural regions of the country:

	1-5 ha.	5-10 ha.	10-20 ha.	20-50 ha.	50-100 ha.	100 ha. and over	Total
Coast marshes	6.53	6.05	11.54	44.51	27.82	3.55	100
River marshes	18.61	15.35	19.13	30.71	14.10	2.10	100
Pasture region	6.15	9.42	25.70	53.28	4.64	0.81	100
Sandy region	21.65	25.51	27.72	21.09	2.70	1.33	100
Moor colonies	9.79	13.05	29.76	42.98	3.77	0.65	100
Horticultural region	21.26	14.31	24.48	36.41	2.45	1.09	100

A short description of the above-mentioned agricultural regions into which the statistics divide the whole country, is to be found at the end of this article.

The difference which exists between the various provinces, which is shown in the following table, chiefly results from the varying extent of the different agricultural regions in each province.

Percentage of each class in properties of an area of 1 hectare and over, divided according to the separate provinces:

Provinces	1-5 ha.	5-10 ha.	10-20 ha.	20-50 ha.	50-100 ha.	100 ha. and over	Total
Groningen	6.74	6.11	14.83	48.10	22.13	2.10	100
Friesland	9.72	9.42	14.41	58.16	7.98	0 31	100
Drenthe	16.31	20 75	33.58	26.77	1.38	1.21	100
Overyssel	19 61	22.59	28.10	25.53	3.16	1.01	100
Gelderland	21.94	18.76	23.22	25.24	8.88	1.96	100
Utrecht	5.29	8.08	26.90	65.03	5.50	1.20	100
North Holland	9.47	10.22	26.83	43.91	7.58	1.99	100
South Holland	6.98	7.60	22.21	47.14	14.15	1.92	100
Zealand	7.33	6.82	12.41	39.30	29.63	4.51	100
North Brabant	16.97	30.70	27.63	17.10	6.14	1.46	100
Limburg	29.89	24.31	20.81	15.84	6.20	2 95	100
Netherlands	13.47	15.04	22.33	35.78	10.58	1 80	100

The following observations throw some light on the *changes* in the cultivation of the ground in Holland. The number of properties of 1 hectare and over has increased 26.9 per cent. since 1881, 23.3 per cent. since 1898 and 14.6 per cent. since 1904. When we consider that the total

area of arable, pasture and garden land has increased 4.7 per cent. since 1888, 2 per cent. since 1898 and 1.4 per cent. since 1904, and that this increase, which is the result of reclaiming and drainage, is much inferior to the increase in the number of properties, it is easily seen that the average area of the latter must have decreased. This agrees with the universal opinion in the country. It is, however, worthy of notice that, while there has been a notable increase in the number of small properties, the statistics do not show a considerable decrease in that of the large ones. While from 1888 there was a falling off in the two largest classes, and from 1898 in the class of 50 to 100 ha., since 1904 all the classes have increased in number. The following table will show this in detail.

Percentage Increase and Decrease in the Number of Properties of 1 hectare (2.47 acres) and over:

	From 1904	From 1898	From 1888
1 to 5 ha	+ 18.2	+ 36.53	+ 47.0
5 to 10 ha.	+ 19.1	+ 20.44	+ 21.6
10 to 20 ha. . . .	+ 3.4	+ 5.07	+ 2.7
20 to 50 ha.	+ 8.1	+ 8.05	+ 6.1
50 to 100 ha.	+ 6.1	— 4.24	— 7.9
100 ha. and over . .	+ 11.9	+ 10.77	— 0.46
Total . .	+ 14.6	+ 23.28	+ 26.9

The comparison of the different agricultural regions is of more importance than that of the provinces. The former results in the following details.

Percentage Increase and Decrease in the Number of Properties since 1898.

Classes	Coast Marshes	River Marshes	Pasture Region	Sandy Region	Moor Colonies collectively	Moor Colonies	Market Garden Region
1 to 5 ha . .	+ 78.50	+ 26.94	+ 29.29	+ 28.60	+ 83.59	+ 32.52	+ 89.23
5 to 10 ha .	+ 35.57	+ 9.88	+ 13.00	+ 20.95	+ 18.44	— 34.57	+ 51.36
10 to 20 ha. .	+ 2.60	— 6.38	+ 5.02	+ 8.74	+ 6.38	— 26.41	— 1.88
20 to 50 ha .	+ 7.73	+ 14.73	+ 8.78	+ 3.16	+ 19.38	+ 55	+ 6.31
50 to 100 ha. .	+ 2.90	— 2.28	— 27.37	— 15.43	— 10.42	— 10	— 10.71
100 ha. and over.	— 13.64	— 7.41	+ 13.64	+ 275	+ 100	—	+ 400
Total . . .	+ 33.94	+ 17.78	+ 14.02	+ 22.19	+ 36.59	+ 2.87	+ 54.53

The coast marsh region, where agriculture and mixed farming are practised, shows a considerable increase in holdings of from 1 to 5 ha. and in those of from 5 to 10 ha.; the larger classes have also increased in number, with the exception of those of 100 ha. and over. The large increase of

holdings of 1 to 5 ha. in the sandy region is interesting. While here the class of 50 to 100 ha. has diminished in number considerably, that of 100 ha. and over shows a large increase.

Although, owing to the incompleteness of the older data, the comparison cannot be exact, yet, as a whole, it is clear that the net result of the development is the slow extension of small holdings ; but the figures given show no cause for apprehension as regards the land becoming too much subdivided, all the more since, through increasing intensity of cultivation, a holding may increase in value while decreasing in area.

While the above observations refer to all holdings of 1 hectare and over, the four types of cultivation will now be considered separately.

Farmers (*Landbouwers*). — The total number of cultivators engaged chiefly in agriculture is 148 844, which can be subdivided among the different classes of holdings as follows :

1 to 5 ha.	55 366
5 to 10 ha.	37 331
10 to 20 ha.	29 411
20 to 50 ha.	23 331
50 to 100 ha	3 214
100 ha. and over	191
Total	148 844

These 148 844 independent farmers cultivate together 1 735 157 ha. (4 287 673 ac.) of arable, pasture and garden land, so that the average size of a holding is 11.66 ha. (28.81 acres).

The average sizes of the holdings in the different agricultural regions are as follows :

Agricultural Region	Average Size of Holding	
	ha.	acres
Coast marshes with agriculture and mixed farming	22.27	55.03
River marshes with mixed farming	9.46	23.38
Pasture region	15.95	39.41
Sandy region	7.67	18.95
Marsh colonies	18.14	44.82
Market garden region	13.79	34.07

Gardeners (*Tuinbouwers*). — The total number of persons engaged in gardening is 15 488. The total area cultivated by them is 35 103 ha. (86 741 ac.), which gives 2.27 ha. (5.61 ac.) as the average size of a holding. Nearly two-thirds of all the gardeners are to be found in the provinces of North and South Holland.

Agricultural labourers. — The total number of agricultural labourers who cultivate 5 ares ($^1/_8$ ac.) or over, amounts to 86 084, with an area of 66 383 ha. (164 036 ac.). The importance of these figures will be realized more clearly when it is considered that in the census of 1909, 114 631 married agricultural labourers (including widowers) were returned. The following table gives a view of the respective conditions in the different provinces:

Province	Number of married agricultural labourers according to the census of 1909	Number of agricultural labourers cultivating areas of 5 ares and over
Groningen	13 973	10 782
Friesland	17 100	11 196
Drenthe	5 234	7 579
Overyssel	5 608	5 674
Gelderland	13 229	16 821
Utrecht	4 967	2 737
North Holland	11 714	3 612
South Holland	18 845	6 241
Zealand	11 559	6 057
North Brabant	9 650	10 034
Limburg	2 752	5 351
Netherlands	114 631	86 084

As is seen, the number of agricultural labourers cultivating less than 5 ares is especially large in the provinces of North and South Holland. The striking difference of the two returns from the sandy regions is due chiefly to a different method of collecting the data.

The total number of 86 084 labourers is divided among the different sized holdings as follows:

Size	Number of labourers	Percentage of total
0.05 to 0.15 ha.	16 094	18.7
0.15 to 0.25 ha.	10 018	11.6
0.25 to 0.50 ha.	16 425	19.1
0.50 to 1 ha.	19 487	22.6
1 to 2 ha.	15 386	17.9
2 to 3 ha.	5 767	6.7
3 to 5 ha.	2 907	3.4
Total	86 084	100

In the case of the two last classes of holdings (those of 2 to 3 and 3 to 5 ha.) the question may well be raised as to whether the labourer's paid work is his chief occupation. According to the statistics, many farmers

who have risen from the ranks of day labourers are often entitled labourers on account of their continuing their former occupation, which may explain the fact of their being thus returned in the statistics. The average size of the areas cultivated by agricultural labourers in the different provinces is as follows :

Drenthe	1.08	2.67
Overyssel	0.92	2.27
Gelderland	0.92	2.27
Limburg	0.81	2.00
Friesland	0.77	1.90
North Brabant	0.73	1.80
Zealand	0.68	1.68
Groningen	0.66	1.63
North Holland	0 47	1.16
South Holland	0.47	1.16
Utrecht	0.44	1.09
Netherlands	0.77	1.90

The folllowing table refers to the different agricultural districts

	ha.	acres
Sandy region	0.92	2.27
River marshes	0.74	1.83
Pasture region	0.66	1.63
Coast marshes	0.59	1.46
Groningen moor colonies	0.50	1.23
Market garden region	0.35	0.86

Persons with a principal occupation other than farming and gardening. — The number of persons whose chief occupation does not consist in agriculture and gardening and who cultivate at least 1 ha. of land amounts to 25 474, with a total area of 98 195 ha. (242 645 acres).

Ownership and Tenancy.

Of the above-mentioned holdings of 1 ha. and over, 106 324, or 50.83 per cent., were cultivated by their owners and 102 832, or 49.17 per cent. by tenants. Of the cultivated area 47.15 per cent. was freehold and 52.85 per cent. leasehold. The following table shows the state of affairs in the various provinces :

PROVINCE	Percentage number of freeholds in the total number of holdings of 1 ha. and over	Percentage area of freeholds in the total area of arable, pasture and garden land
Groningen	65.72	68.30
Friesland	35.15	26.86
Drenthe	52.41	56.07
Overyssel	67.87	67.64
Gelderland	55.45	55.76
Utrecht	43.96	42.79
North Holland	41.55	41.41
South Holland	34.40	34.22
Zealand	26.27	26.74
North Brabant	56.25	52.21
Limburg	54.90	47.51
Netherlands	50.83	46.96

According to the above, in 5 provinces (Groningen, Overyssel, Drenthe, Gelderland and North Brabant) more than half the area is cultivated by the owners. In the eastern provinces, where the soil is chiefly sandy, freehold is most usual; while leasehold is more prevalent in the western provinces, where the soil is better. The marsh land of Groningen is, however, an exception, for here freehold is predominant.

Here should be mentioned a curious arrangement in farming, the leasing of land by farmers to their sons. This occurs in some districts when the parents grow old. The following table gives some information on the subject:

PROVINCE	Total Area leased		Area leased to Children by their Parents		
	ha.	acres	ha.	ac.	Percentage of whole area leased
Groningen	61 045	150 846	14 789	36 544	24.23
Friesland	167 933	414 972	13 316	32 905	7.93
Drenthe	48 335	119 438	3 350	8 278	6.92
Overyssel	51 733	127 835	2 661	6 575	5.14
Gelderland	108 462	268 016	2 573	6 358	2.37
Utrecht	50 261	124 198	3 522	8 703	7.01
North Holland	110 643	273 405	19 039	47 046	17.21
South Holland	153 178	387 512	18 622	46 016	12.16
Zealand	103 850	256 619	11 209	27 698	10.79
North-Brabant	111 313	275 061	5 785	14 295	5.20
Limburg	59 446	146 894	1 523	3 763	2.56
Netherlands	1 026 200	2 535 800	96 389	238 183	9.39

According to this table, this system of leasing is most in vogue in provinces with large holdings.

Another important matter is the cultivation of private property through the medium of specially accredited persons. Of late years, it has been more and more customary in the North of the country for the large landed proprietors to move to the towns, leaving their property under the management of a bailiff (" zetboer " or " bedryfsboer "). This development is not approved of either from the point of view of the finances of the district, or from that of the cultivation of the property. It is regarded as being in many cases only a preliminary step to letting the estate, which easily comes about on the death of the owner, as his children feel little interest in a place to which they are strangers.

In the whole country, there are 515 estates under bailiffs, with an area of 22 322 ha. (55 159 ac.), *i. e.* 1.17 per cent. of the area of arable, pasture and garden land. In Groningen, the estates under bailiffs are more numerous than in any of the other provinces, though the practice obtains also much in Zealand.

The percentage of owners cultivating their own properties in the four chief classes is as follows :

	%
Farmers	46.75
Gardeners	40 51
Agricultural labourers	39.83
Persons whose chief occupation is not agriculture or gardening	57.78

Thus gardens are more commonly leased than are farms.

The great expansion of the gardening industry in those provinces in which leasing is prevalent, has made the latter the most usual method as regards horticulture throughout the whole country. The conclusion should not, however, be drawn that the practice is especially advantageous. In provinces where horticulture has been longest and most intensively carried on, the gardeners show a strong tendency to acquire land of their own. Thus, in the provinces of North Holland and South Holland, and where much horticulture is practised, more gardeners than farmers cultivate their own land.

Of the 86 084 agricultural labourers with 5 ares ($^1/_8$ ac.) and more of land, 26 330 were owners and 59 754 tenants.

Fewer owners are to be found in the small classes of holdings than in the larger. While scarcely 14 per cent. of the agricultural labourers cultivating 0.05 to 0.15 ha. ($^1/_8$ to $^3/_8$ acre) are owners, this percentage rises to 47 for properties of 2 ha. (5 acres) and over. The following summary treats of this matter more in detail :

Class	Owners	Tenants	Percentage of Owners in the Total
0.05 to 0.15 ha	2 238	13 856	13.91
0.15 to 0.25 ha.	1 754	8 264	17.51
0.25 to 0.50 ha	4 318	12 107	26.29
0.50 to 1 ha.	7 328	12 159	37.60
1 to 2 ha.	6 587	8 799	42.81
2 to 3 ha.	2 751	3 016	47.70
3 to 5 ha.	1 354	1 553	46.58
Total	26 330	59 754	30.59

Ownership occurred more often than tenancy amongst those persons whose principal occupation was not agriculture or horticulture; 53.36 per cent. of these persons were owners and 57.78 per cent. of the area cultivated by them was their own property.

The following table contains information regarding the occurrence of private ownership and tenancy in the different classes of holdings:

Classes	Percentage number of holdings of each class farmed by owners	Percentage of areas in each class of holding farmed by owners
1 to 5 ha.	50.41	50.43
5 to 10 ha.	55.74	54.52
10 to 20 ha.	52.44	51.21
20 to 25 ha.	43.80	42.24
50 to 100 ha.	37.43	37.76
100 ha. and over	63.43	66.20
Total	50.83	46.96

According to the above, tenancy occurs more frequently in the case of properties of 20 to 100 ha. (49 to 247 ac.) than in those of less than 20 ha. Ownership is very frequent also where the properties are over 100 ha., but the number of these is very small. The frequent occurrence of tenancy in the case of properties of 20 to 100 ha. is partly due to the fact that such are most numerous on the best soil, where the tenant system mostly obtains. Holdings of less than 20 ha. are, on the contrary, usually situated in the sandy regions, where ownership predominates.

The results of calculation show that the extension of tenancy noticeable at the time of the earlier statistics has been maintained since 1904; details on this point are given below:

Class.	Percentage of Owners in the total of persons cultivating holdings of at least 1 hectare			
	1888	1898	1904	1910
1 to 5 ha.	59.2	57.1	54.3	50.4
5 to 10 ha.	61.7	60.5	58.5	55.7
10 to 20 ha.	59.9	58.3	56.7	52.4
20 to 50 ha.	51.8	49.1	46.9	43.9
50 to 100 ha.	44.7	42.3	40.8	37.4
100 ha. and over	58.1	52.8	52.2	63.4
Total	58.5	56.6	54.4	50.8

While in 1888, 58.5 per cent. of the total number of properties of at least 1 ha. were cultivated by their owners, this percentage sank in 1898 to 56.6; in 1904 to 54.4 and in 1910 to 50.8. All the different-sized holdings shared the same fate, except these of 100 ha. and over, of which the number farmed by their owners shows a considerable increase. The different districts show, however, a different state of affairs. It is noticeable that of the 11 provinces only one (Overyssel) shows an increase — and that a small one — of the owners in proportion to the tenants. Further details are to be found in the following table.

Increase (+) *and Decrease* (—) *in the Number of Owners in* 100 *Properties during the Period* 1898-1910.

PROVINCE	Total of Properties	1 to 5 ha.	5 to 10 ha.	10 to 20 ha.	20 to 50 ha.	50 to 100 ha.	Over 100 ha.
Groningen	— 11.2	— 9.3	— 10.2	— 12.0	— 10.6	— 5.3	— 5.9
Friesland	— 3.2	— 0.2	— 7.7	— 8.2	— 6.9	— 14.1	+ 50.0
Drenthe	— 6.5	— 5.8	— 4.6	— 5.4	— 1.6	— 12.9	
Overyssel	+ 0.1	— 1.0	+ 4.5	— 0.9	+ 0.1	— 5.8	—
Gelderland	— 2.6	— 3.7	— 1.7	+ 0.7	+ 0.3	— 4.5	+ 39.7
Utrecht	— 3.8	— 6.5	— 3.8	— 2.5	— 2.1	— 9.5	—
North Holland	— 7.8	— 10.4	— 10.3	— 7.0	— 2.6	+ 4.2	+ 15.3
South Holland	— 8.5	— 7.9	— 9.6	— 9.0	— 5.8	— 6.8	— 5.3
Zealand	— 9.2	— 9.1	— 12.3	— 16.8	— 5.9	— 2.1	+ 8.1
North Brabant	— 10.0	— 11.4	— 7.8	— 8.9	— 12.0	— 5.4	— 2.6
Limburg	— 1.7	— 3.0	+ 1.8	— 0.4	— 0.9	— 4.8	+ 2.7
In the whole Kingdom.	— 5.8	— 6.7	— 4.8	— 5.9	— 5.2	— 4.9	+ 10.6

The conditions which obtain in the various agricultural regions may be gathered from the following few remarks.

The percentage decrease in the number of owners is greatest in the coast marshes, especially in the case of small holdings. After these come the moor-colonies, the river marshes, the horticultural region, the pasture region, and lastly the sandy region.

A short Description of the Agricultural Regions of the Netherlands

The following principal groups have been distinguished in the statistics on account of the nature of the soil and the industries obtaining.

Group I: Coast marshes with agriculture and mixed farming.

This district is distinguished by its usually large properties. In some parts, however, numerous smaller holdings exist; these are chiefly devoted to the cultivation of crops requiring much attention: potatoes, onions, beans, etc. Greenhouse cultivation is practised also. The proportion between arable and pasture land is very variable; in some districts, there are very few permanent pastures, and these are decreasing, *e. g.* in Groningen and Haarlemmermeer in Zealand. In other places, the pastures are gradually extending and exceed the arable area. In general, agriculture is prevalent in the coast marshes. With the exception of the Groningen and some smaller districts in other provinces, cereal cultivation has decreased lately and only occupies one quarter or one third of the arable land. In addition to cereals and pulse crops, the most various crops of commerce and industry are grown, amongst which potatoes and sugar beets have a continually increasing importance.

The coast marsh group includes the following districts in the different provinces:

Groningen: Noordelijke bouwstreek; Noordelijk Westerkwartier; Centrale bouwstreek; Klein-Oldambt; Nieuw-Oldambt.
Friesland: Kleibouwstreek.
North Holland: Noordoostpolders: Meerlanden.
South Holland: Rijn-, Delf-, en Schielandsche droogmakerijen; Ijsselmonde en Dorsche Waard; Hoeksche Waard; Voorne, Putten en Rozenburg; Goeree en Overflakkee.
Zealand: The whole.
North Brabant: Noordwestelijke zeekleigronden.

Group 2: River marshes with mixed farming.

This group differs from the first in the nature of the soil, the nature of the industries and the size of the holdings. The large properties become more and more split up into small holdings, which are here much the most numerous. Pasturage is in the ascendancy. As well as cereals

a great deal of potatoes is grown by the small farmers. Commercial crops are seldom met with. The grass orchards are characteristic.

The group includes the following districts:

Overysset: Ijselstreek.
Getderland: Ijsselstreek; De Lijmers; Betuwe; Tielerwaard; Bommelerwaard; Maas en Waal.
Utrecht: Kleigebied van den Krommen Rijn.
North Brabant: Land van Heusden en Altena.

Group 3: Pasture Region.

To this belong those parts where the land is exclusively, or almost exclusively, used for grazing. The farms are, as a rule, 15 to 30 ha. (37 to 75 ac.) in extent. Larger or smaller ones are of rare occurrence. The soil is generally low-moor and loam.

The several districts are:

Groningen: Centrale weidestreek
Friesland: Kleiweidestreek; Veenweidestreek; Eilanden
Overyssel: Weidegebied.
Utrecht: Eemland; Noordwestelijk weidegebied; Lopikerwaard; Kleigebied van Ijssel en Ouden Rijn.
North Holland: Eilanden; Middengewest; 't Gein; Moordelijke duinstreek; Nordelijk Westfriesland.
South Holland: Noordelijk klei- en veengebied; Rijnland; Delfen Schieland; Land van Gouda en Woerden; Krimpenerwaard; Alblasserwaard en Vijfheerenlanden.

Group 4: Sandy Region.

The grassland, with the exception of newly made farms, is to be found along the watercourses. Waste places and woods are of frequent occurrence. Although the proportion of arable to grass varies from place to place, their extent is about equal over the whole region. The principal crop is rye, oats and potatoes being next most largely grown. Buckwheat has fallen off a great deal. On an average, 70 per cent. of the arable land is under grain. While the grain was formerly mostly sold off, it is now fed and much concentrated food is bought in addition. The farmers' principal sources of revenue are milch cows, pigs, and poultry. The farms are generally small: 70 to 90 per cent. of the cultivated land consists of holdings of less than 20 ha. (50 acres).

The following districts belong to this region:

Groningen: Westerwolde
Drenthe: Zandgebied.
Overyssel: Zandgebied.
Gelderland: Veluwezooom; Nederveluwe; Overvelcuve; Oostelijke Veluwe; Graafschap Zutphen; Rijk van Nijmegen.
Utrecht: Zandgebied.
North Brabant: Land van Cuyk; Meijerij;; Zuidelijke en oostelijke Zandgronden.
Limburg: Noord-Limburg.

Group 5 : Moor Colonies.

There is only one true moor-colony district, *viz.* the Groningen moor colonies. Adjoining them are, however, two districts which should be regarded as of different types, the Drentsche Veen- or Zandgebied, of which the larger part is included in the moor colonies and the smaller in the sandy region; and the Woldstreek (Groningen), which possesses no actual moor colonies, although its farms have much in common with them.

Group 6 : Horticultural Region.

This region includes districts in which agriculture and cattle breeding, especially the latter, are of considerable importance, but nevertheless are chiefly characterized by horticulture, owing to the extensive tracts devoted to this industry.

The districts included in it are :

North Holland : Drechterland; Geestmerambacht; Zuidelijke duinstreek.
South Holland : Zuidhollandsch bollen- en weidegebied; Westland.

In conclusion, the accompanying table gives a summary of the areas in the various regions.

	Total area : acres	Arable land : acres	Grass land : acres	Horticultural land : acres
Coast marshes	1 482 313	788 267	417 238	27 308
River marshes	679 474	248 413	278 498	51 106
Pasture region	1 571 502	87 789	1 111 623	27 196
Sandy region	3 781 171	862 812	1 035 309	44 645
Moor colonies.	300 273	131 903	44 180	3 892
Horticultural region . .	242 371	23 900	104 197	35 287
Total . . .	8 057 105	2 143 084	2 991 045	189 434

1450 – **The Alps and Varieties of Pastoral Nomadism in Tarentaise, France.**

ARBOS, PH. Les Montagnes Pastorales et les variétés du Nomadisme Pastoral en Tarentaise, France. — *Annales de Géographie*, N. 118, pp. 323-345. Paris, July 15th 1912.

Although the name Tarentaise is applied to the whole ef the upper valley of the Isère until its confluence with the Arly, it only assumes its character of high mountain valley above Montiers. This region, typical among the valleys of the French Alps in its pastoral economy and the resulting forms, presents, owing to the variety of natural conditions, most diverse adaptations to one and the same method of exploitation. It is the extent of its high lying grazing land which has determined the pastoral character and the rural economy of this region.

The high pasturage is formed in Tarentaise by the "montagnes" or Alps. The "montagne" is defined by the almost industrial character of its farming. It concentrates a large number of animals in the hands of a small nnmber of men specialised in their work. Where concentration does not take place and each family accompanies and herds its cattle on Alpine grass land, the latter takes the name of "montagnette d'été". This individual form of summer grazing, which is constant in the outlying spurs of the Alps, is practically no longer found in Tarentaise. The "montagnettes d'été" have merged into "montagnes" for the greater convenience of the work of the men and better utilisation of the milk. They had, for that matter, always formed an exception. Tarentaise was, and is above all, a country of "montagnes".

The latter belong either to communes or private individuals. Frequently the communes carry on the business in accordance with the old practice of "pasturing their cattle together and pooling the products" and "for the preservation of the montagne and poor people of the locality" for which they require to-day as formerly that no person shall turn out to pasture more animals than he puts up in the winter. A varying number of authorised agents attend to proper administration. They concern themselves with the hire, upkeep and payment of the staff. They direct and supervise the measure of the milk intended to form the quota of each. The majority of the "montagnes" however are worked for personal account by private persons, who are sometimes the owners and sometimes have rented them either from the commune or from private persons. They form a true social class of pastoral contractors, the "montagnards", who not ouly concentrate upon their pasturage the animals of one region, but even centralise the management of several "montagnes", They have always a fairly large stock of cattle of their own which it is impossible for them to keep at home and feed apart from summer grazing. They put them out for the winter either in some commune in a region where the reserve forage store is more than sufficient for the local herds, or in the villages of the Basse Tarentaise, which even more than the latter, are well endowed in the matter of winter forage resources. A "montagnard" pcssessing 60 head of cattle may keep 20 in the byres and offer the others to a winter keeper, to whom he yields up all the profits they may prodnce. However numerous his cows may be, nevertheless the montagnard can rarely rely on them alone for the proper exploitation of his pasturage. For the summer he obtains cattle from outside; he buys animals in the spring which he sells again in the autumn, but this speculation, frequent in the foot-hill regions of the Alps, and more facilitated by the creation of agricultural credit banks, is pretty rare in

Tarentalse ; so again he, with a view to summer grazing, hires animals for which he pays a royalty, assessed sometimes according to the milk yield, and more often fixed at a lump sum, 25 frs (£1), on the average. On the 24th of June all the cattle are together on the montagne, leaving it between the 10th and 27th of September. Tarentaise however, like many other Alpine valleys, is not diversified merely by the coming and going between the montagne grazing and the village. This simple form is restricted to the high valley where natural conditions do not compel or allow anything more complicated, as the permanent establishments of the men are at such high levels that the cattle reach and leave high pasturage direct without intermediate stages.

Everywhere, except in the Tignes valley, the " montagnette " is interposed between the montagne and the village. Above the last cultivations stretch grass lands and pastures where the snow is less early and less late than on the Alps. These consequently form a valuable reserve when the Alps are not yet fit for grazing though the forage below is exhausted. These are the " montagnettes " which are also called " pâturages de mi-côte ", " basses montagnes " and " petites montagnes ". While on the " mountain " the cattle are concentrated on a few grazing areas ; in the " montagnette " each owner follows his animals. The necessities of pastoral life predominate over those of agricultural life, and often the entire family takes up its residence at the beginning of May in the chalets on the " montagnettes ". On the 24th of June everybody goes to the village, which is left again at the end of September in order to receive, on the " montagnette ", the cattle coming from the high pastures. During the summer the " chalets de mi-côte " or half-way chalets remain deserted ; the men may at the most come for a few days to mow the hay. It is this forage stacked in piles on the spot, which will be consumed by the cattle in the autumn. It is however only fed to them after they have eaten the aftermath until the first snows. They are then stalled half way up the hill, for a more or less lengthy period according to the number of head of cattle, the grass resources of the " montagnette " and the village reserves ; at times this stay is terminated at All Saints (November 1st) though it mostly lasts until December ; Christmas marks the return to the village.

Migrations of a like rythm determined by physical conditions are followed by the inhabitants of the village towards the valley. When March begins the cattle and people go down into the valley, the former to use up the forage brought in during the previous summer, the latter to undertake the spring work, the most importaut of which formerly was that of the vine. When this spring work is completed, about the 15th of May, they go to the " montagnette " where the barn still

contains the forage, and round which the cattle. turned into field, are prepared for the " montagne ". After the 24th of June the men, free from the worry of the summer pasture and cattle, set themselves entirely to agricultural work, harvesting and hay-making, at first in the valley and then halfway up the slopes. As soon as the crop is got in at the very top, they must go right down to the bottom for the sowing; then for the same purpose go up the next stage, and when the end of September comes, receive the cattle from the "montagnette" where it is grazing the aftermath; after which, about the 30th of October, the cattle are suddenly taken to the grass lands below before taking them again half way up the hill for All Saints Day.

The life of men and animals is here one perpetual displacement. The law of shifts, in different degrees of complexity, thus dominates the entire life of Tarentaise. Whatever the variety of the forms of migration here recapitulated, all are due to the same causes, extensive grazing and farming, the utilisation of all the resources offered by the slopes of the valley.

In order to avoid the loss and fatigue of coming and going daily, permanent establishments have been created, inhabited temporarily, where the men carry out work on the spot and where the cattle leave their manure likewise on the spot.

1451 – Calculation of the Cost of Production of Agricultural Produce.

SEDLMAYR, E. C. Berechnung der Produktionskosten. (Mitteilung aus dem Institut für landwirtschaftliche Betriebslehre und Buchführung der K. K. Hochschule für Bodenkultur in Wien). *Mitteilungen der Landwirtschaftlichen Lehrkanzeln der K. K. Hochschule für Bodenkultur in Wien;* Vol. I, Part 2. Wien, Juli 1912.

Starting from the fundamental formula :

A = P (Aufwand = Produktionskosten)
Expenses = Cost of Production,

the author in enumerating the various items of expenditure which make up the cost of production, naturally includes among these, besides the outlay in cash, the produce in kind and the labour both of men and of animals ; also the wear and tear of buildings, of improvements and of the dead stock under the form of a quota of amortisation (whenever these means of production contributed to the results), as well as taxes and rates, the cost of the circulating capital (materials and labour) not otherwise taken into account, and the quota for administration and management. In the investigation on the cost of production the author has fixed the following rates of interest for the capitals engaged.

For the capital in land		about	3 %
» » » » improvements		»	4 %
» » » » buildings		»	4 %
» » » » machines and implements	. .	»	5 %
» » » » live stock		»	5 %
» » circulating capital		»	6 %

In the first place he examines the almost insurmountable difficulties, due to the complex nature of farming operations, which are encountered in fixing the values of certain items of expenditure.

There is a whole series of expenses which do not go to the exclusive benefit of one particular product, but which maintain generally the productive power of the soil so as to ensure the continuity of production of the farm as a whole.

Thus for instance manuring with stable manure cannot be debited to one single crop ; the economical effect of indirect manuring by means of liming cannot be translated into cash ; the same may be said of the fertilizing effect of growing leguminous forage plants upon the succeeding crops. These factors which are not susceptible of being valued by themselves vary from year to year according to the weather and to a great extent as a function of the moisture of the soil.

In order to get at the cost of production of the single crops these factors ought to be fixed, though strictly speaking they are incalculable.

The distribution of those expenses that in their totality concern the whole farm is another difficult problem, and the author questions whether it be not a serious error to distribute rent or interest on capital in equal measure on beets and on cereals or forage plants.

In the distribution of the expenses for draught animals the same difficulties are encountered. The method generally followed consists in dividing the total expense by the total number of work days; the result becomes the factor fixing the cost of the single day's work which in its turn is used in calculating the cost of production of the various crops.

Independently of the influence of the work days employed for the other crops, in the price of the day's labour for one particular crop, there is another cause of error in this calculation, namely that the work day has a uniform cost price without considering the quality of the work performed ; the light work at harvest time is considered equal to the heavy work of ploughing or carting beets.

In certain farms not provided with good roads or situated at a distance from the railway or sugar factory, the carting of beets may influence to a great extent the cost of the animals' working day. These causes of error are generally recognized, but they are not always justly valued.

The author gives some instances by means of which he shows that frequently these errors attain such a magnitude as to render the results of

calculations on the costs of production absolutely useless. He examines the cost of manuring beets and notes how in the mere valuation of stable manure a possible error of 20 per cent above or below the figure must be taken into account, even adopting the most rigorous up-to-date methods of valuation.

Another difficulty arises in the distribution of the same outlay among the various crops which successively benefit by it.

Thus for instance if 50 per cent is the proportion fixed upon to be debited to beets it must be recognized that here also there may be an error in the distribution, and that in reality 40 per cent or 60 per cent of this outlay is utilized by the beet crop.

In a practical case the following figures would be obtained:

Farmyard manure given to beets per acre	Basis of the calculation	Limit of error	
		Minus	Plus
Quantity of manure	16 tons	16 tons	16 tons
Value per ton.	8*s.*	6*s.* 4 $^{3}/_{4}$*d.*	9*s.* 8 $^{1}/_{4}$*d*
Total value of manure	£6 8*s.*	£5 2*s.* 4*d.*	£7 15*s.*
Proportion debited to beets	50 %	40 %	60 %
Value debited to beets	£3 4*s.*	£2 0*s.* 11*d.*	£4 13*s.*

Thus in this case the single item "manuring with farmyard manure" might introduce an error of £2 12*s.* 1*d.* per acre in the calculation of the cost of production of beets.

The author observes that the method itself is not rational: in fact it consists in debiting the crop with the expense of manuring instead of with the real quantities of fertilising substances withdrawn by the crop from the soil. The necessity of keeping for the present to this method is due to the lack of data on the diminution of value of a farm caused by the various crops; the method itself, strictly speaking contains already a cause of error.

It is lastly to be noted that if one cannot help admitting, in the most rigorous valuations of stable manure, a limit of error like the one fixed in the case which has been examined, the error becomes undoubtedly greater if empirical or irrational methods of valuation are adopted.

Errors of minor importance creep into the cultural accounts of beets if this crop is debited with the whole outlay of the deep ploughing and hoeing, both of which operations benefit to a certain extent the succeeding crops also. The distribution of the share of amortisement of machines and implements is not always correctly done.

To show further how unreliable a cultural account may be, even when compiled with the data furnished by analytical book keeping, the author gives the items of the account, marking with one query (?) those that can not be given with absolute exactness, with two (??) those containing fairly considerable sources of error, and with three (???) those containing decidedly important ones.

The result is the following table of the cost of production of beets per acre.

	£	*s*	*d*
1 Seed		6	8
2 Quota of farm yard manure (???)	2	8	5 1/2
3 Quota of artificials (??)	2	2	5 3/4
4 Quota of indirect manuring with lime (?)		6	11
5 Labour: day labourers and piece work	2	1	4
» farm hands (?)		5	7
6 Draught animals (??)	1	11	6 1/4
7 Quota of steam ploughing (??)		5	9 3/4
or of deep ploughing with draught animals (??)	—	—	—
8 Quota of amortisement:			
a) of improvements (?)			11 3/4
b) of farm buildings (field railway) (?)		1	5 3/4
c) of machines and implements (?)		1	11 1/2
9 Quota of up keep:			
a) of improvements (?)		1	4 1/4
b) of farm buildings (field railway) (?)		1	7 3/4
c) of machines and implements (?)		1	2 3/4
10 Quota of general expenses administration and management (??)		2	8 1/2
11 Quota of direct taxes (??)		6	11
12 Quota of interest based on:			
a) capital in land (rent) (???)	1	11	3
b) inventory of dead stock (?)		1	3 3/4
c) circulating capital (??)		3	4 3/4
Total outlay per acre	12	3	—
13 Value of leaves and tops of beets to be deducted 124 cwts at 1 1/2 *d* per cwt (??)		15	8
Outlay per acre of beets	11	7	4

With a crop of 13¼ tons of topped beets per acre the cost of production per ton would be 17*s*. 1 3/4 *d*.

The predominance, in this account, of data containing sources of error is evident.

The same difficulties are encountered in establishing the exact cost of animal products such as milk, wool, meat, etc. or the cost of the animals raised on the farm. In these accounts the valuation of the forage

and straw produced in the farm is of capital importance ; the same with the valuation of farmyard manure ; both these valuations contain sources of error.

Attempts have been made to eliminate the difficulties attendant upon the valuation of forage produced in the farm by introducing into the account of the cost of production of animal products, the actual cost price of the forage in the farm itself. Such a proceeding is frequently theoretically erroneous. It introduces into the stock breeding industry the profit or loss due to the forage crop ; this method is only justified when the whole of the forage produced by the farm is used for the stock and there is no other way of utilising it. To debit milk stock with forage at the low cost of production, where the open market pays it a higher price, cannot be right . Also the method of calculating the forage produced in the farm on the basis of the market price has its drawbacks; in many cases the valuation price of the forage might go much below its effective cost of production ; nevertheless if the method of debiting the live stock with the price represented by the effective cost of production of the forage be adopted, the errors inherent in this calculation act in their turn on the cost of production of the animal products.

Here also it will be sufficient to examine the principal items of an account of the kind in order to be convinced that the limits within which the results of the calculation may vary are very wide apart. An error of 10 per cent in the valuation of forage and of straw in the account of the cost of production of milk is an error that must be allowed for even in the most rigorous calculation ; similarly in the estimation of farmyard manure a limit of error of 20 % is not excessive. On the above basis the calculation of the daily cost of a milch cow would be liable to the following possible variations :

Calculation per head and per day

	Basis of the calculation	Limit of error	
		Minus	Plus
	pence	pence	pence
Forage produced on the farm	6.66	5.99	7.33
Litter	0.76	0.67	0.86
Total	7.42	6.66	8.19
Manure produced to be credited	2.85	3.42	2.28
Rest to be debited	4.57	3.24	5.91

In only three items of the cost of production of milk there is a daily variation per head varying from 3.24*d.* to 5.91*d.* The final error on a stable containing 100 cows may thus attain £200. It must also be remembered that in the distribution of general expenses and in the valuation of the calves that are born, new errors are introduced into the milk account.

Professor Howard of Leipzig, the great authority on the question of the calculation of the cost of production of agricultural staples, who for many years followed with his elaborate systems of book-keeping, in a considerable number of farms, the cost of production of agricultural produce, has arrived at some final results which do not fully satisfy the author of the paper.

From Prof. Howard's book-keeping it appears, for instance, that in an average of several years out of 133 farms only 6 had succeeded in obtaining a profit from breeding cattle ; and this almost exclusively in model farms situated in Saxony, Silesia, and the provinces of Hanover and Posen, under perfect management, and which have for years kept careful accounts of the several branches of production. The author says that it cannot be easily believed that 95 per cent. of these farms, which are certainly among the best in Germany, work at a loss, and that this only affords a proof of the impossibility of attaining an exact calculation of the real cost of production. The figures here given are taken from the interesting data communicated by Howard himself on the cost of production of some staples in 140 farms ; thy represent averages of 3 to 5 years.

KIND OF PRODUCT	Cost of production per cwt.			
	Lowest		Highest	
	s	*d*	*s*	*d*
Wheat	3	10 1/4	11	7 1/2
Rye	3	5	10	11 1/2
Barley	4	2 3/4	11	10
Oats	3	11 3/4	13	3
Potatoes		11	3	0 1/2
Beets		7 1/4	1	8 1/4

The farm which produced the hundredweight of wheat at 3*s.* 10¼*d.* showed for rye a cost of production of 7*s.* 0½*d.* ; while the farm that gave the lowest cost of production for rye, 3*s.* 5*d.*, produced wheat at 6*s.* 9*d.*, oats at 4*s.* 10½*d.* and barley at 6*s.* 8 ¾ *d.*

Such oscillations in the cost of production obtained by systematic book-keeping are explained by the fact that the requirements of the soil for the various plants cannot be calculated, and that in their place manure is introduced into the account, which in its turn is not only more or less exactly valued, but is also often badly distributed. In the calculation of the interest or of the rent this item of outlay is not distributed among the lands of the farm in greater or lesser measure according to the quality and value of the single fields. The other causes of error enter more or less into Howard's method of analytical book-keeping, as into the other methods; results are obtained which, here also, do not represent the real cost of production. If then not even Howard's analytical book-keeping succeeds in yielding this factor, how is it possible without the assistance of this method to calculate satisfactorily the cost of agricultural produce. Every attempt to ascertain the cost of production based only on data furnished by experience or simply occasional, must *a priori* be considered as unsuccessful. An unbiassed examination of the problem of the cost of production of agricultural commodities leads to the conclusion that an exact calculation of the cost price of most agricultural produce is not possible at present.

A simpler method of calculating the cost of production, and which according to the author deserves to be remembered because it often yields most instructive results, is the one adopted by Laur of Zürich.

Laur opposes to the net revenue of the farm (Reinertrag) the normal interest of the capital engaged in the farm which contributed to production The figure which he thus obtains is called by him "Reinertrags differenz" or difference of the net revenue, and from various points of view it deserves serious consideration.

By distributing proportionally the difference of the net revenue among the various groups of gross revenue, derived from the single branches of production of the farm, the costs of production of the results of these various branches of production of the farm may be obtained.

The following is a general example:

Gross revenue of the single branches of production.

	£	s	d
13 200 gallons of milk at 8.65*d.*	475	14	2
984 tons of beets at 16*s.* 1½*d.*	793	7	0
1968 cwt. of wheat at 7*s.* 8*d.*	754	8	0
984 cwt. of barley at 6*s.* 5¼*d.*	316	14	0
Other products	436	10	2
	£2776	13	4

Supposing the net revenue of the farm to be £257 16*s.* 8*d.* and the capital £9911 13*s.*, the following will be the difference of the net revenue (Reinertragsdifferenz).

Net revenue	£257 16*s.* 8*d.*
Interest at 4 % on the capital .	£396 13*s.* 4*d.*
Difference of the net revenue (Reinertragsdifferenz) . . .	£138 16*s.* 8*d.*

The expenses of production exceed the returns (Verwertung) by £138 16*s.* 8*d.*

If the prices of the items of the returns (Verwertungspreise) be raised by :

$$\frac{£138\ 16s.\ 8d. \times 100}{£2\ 776\ 13s.\ 4d.} = 5\ \%$$

the following prices for the single items are obtained :

	Returns price	+ 5 % of same		Cost of production
Milk	8.65*d.*	+ 0.23*d.*	=	8 88*d.*
Beets	16*s.* 1.50*d.*	+ 9.68*d*	=	16*s.* 11.18*d*
Wheat	7*s.* 8 00*d.*	+ 4.60*d.*	=	8*s.* 0.60*d.*
Barley	6*s.* 5 25*d.*	+ 3.86*d*	=	6*s.* 9.11*d*

From the above it is seen that in order to cover the expenses of production, the products must be utilized at a price on average 5 per cent. higher. And this is a datum of the highest practical importance.

But if the costs of production thus obtained were considered as the real costs of the products another error would be committed, because with the returns price given there might be a loss on the production of milk and a profit on beets, or viceversa.

Laur's synthetical method (Einheitsverfahren) evidently cannot afford such a result; it only tells us if the single branches of production of a farm, as a whole, have yielded a profit or caused a loss.

Rationally used, this method affords statistical material which can well be utilized from the point of view of political economy and agricultural policy.

The farmer interested in the problem of the cost of production of his produce, especially with the object of ascertaining which branch of production and which arrangement of the farm yields the most profit, even using this method, will not find a satisfactory answer.

The author mentions also another way which allows the cost of production of the products of the farm to be calculated on the basis of Laur's synthetical method.

The research of the cost of production and the compilation of analytical accounts remains though, in spite of the sources of error they contain, an indispensable requisite of scientific investigation. They may also render good service to the practical farmer provided scrupulous care be taken to eliminate, or to reduce as far as possible, the causes of error, and the results are interpreted at their just value. It must also be borne in mind that in those branches of production of the farm which are less intimately connected with its chief branches of production, the cost of the products may be more rigorously calculated.

Thus for instance in the case of a meadow which is rented, and manured with bought artificials, it will not be difficult to calculate with sufficient exactness the cost of production of the forage produced by such a meadow. The account of the cost of production opened for the breeding of pigs, among the accounts opened for breeding stock, will give all the more trustworthy results inasmuch as values, entering into the calculation, for the foodstuffs and manure produced in the farm have but a relative importance. In a farm which possesses a brick kiln, the cost price of the bricks produced can certainly be calculated without fear of incurring considerable errors.

Analytical accounts can afford good practical results when they are kept with the object of finding out the relative returns which may be expected from crops and from the different kinds of live stock.

The object in this case will be attained only when such crops as may be considered equivalent, in the rotation are compared with each other.

On this basis, the comparison of the data (obtained either by calculation or by analytical bookkeeping) concerning the various crops, and more precisely the comparison of those on sugar beets with those on mangolds, those on wheat with those on rye, those on forage vetches with those on clover, will yield results that often show which crop is the more profitable. The results of these calculations, if they are not intrinsically trustworthy, are comparable with each other, because in these calculations there are approximately the same causes of error in the valuation of farmyard manure, of the labour of the draught animals, of the secondary products and in the distribution of other common expenses.

A further application of Laur's method will in its turn show whether the substitution in the rotation of one crop for another has caused an increase of profits. By repeating the calculation in such a way as to have as a basis the same quantity of manure and the same production of forage, the errors inherent in the calculation itself and to which reference has already been made, would be still further reduced.

What has been said for these comparative accounts holds good also for live stock kept for fattening and for the production of milk. By comparing the relative, carefully calculated figures of the costs of production, and by comparing these with the actual prices of the products, it will be possible to decide whether it be more profitable, in the case under examination, to keep milk animals or those for the production of meat or in the case of sheep those for their wool or for their flesh.

It would on the other hand be completely fallacious to give a greater development to the keeping of stock for the production of milk or meat etc., or to suppress this branch of animal industry, according to the results on the cost of production calculated analytically for any produce of breeding stock.

Such a direct deduction based on the result of the calculation of the cost of production is only possible when it is beyond the limits of error. Supposing that the calculation of the cost of production gives favourable results even when this cost of production is exaggerated to the utmost in the values which form it, the conclusion that this branch of production really gives good economic results will appear justified. If on the other hand in a similar investigation on the cost of production, the component values have been reduced as much as possible, and yet the cost of production turns out high, it will be very doubtful whether this branch contributes anything to the total revenue of the farm

The author lastly observes that the calculation of the cost of production of agricultural staples has another great advantage, namely that of compelling all the inner exchanges of the farm to be followed so as to isolate the items of expenditure for each product. This translation into figures of the whole complex process of production, may often bring into evidence facts of great value in forming an opinion on the whole trend of a farm. This advantage appears still more clearly when in keeping account of the expenses, book-keeping by double entry is practised. In this especially, says the author, lies the great merit of the method adopted by Prof. Howard.

The farmer who calculates the cost of production of his products must not only know intimately the essence of these calculations, but also how to estimate without bias the causes of error. If their importance be not sufficiently and completely valued the calculation of the cost of production may not only fail to yield any advantage but may lead to the adoption of erroneous measures.

AGRICULTURAL INDUSTRIES.

1452 - Abnormal Butters and Coconut Oil Adulteration. DAIRYING

LAHACHE, J. and MARRE, FRANCIS. Beurres anormaux et beurres fraudés avec la graisse de coco. — *Revue Générale de Chimie pure et appliquée*, 14th Year, Vol. XV, No. 15, pp. 273-284. Paris, July 28 1912.

The existence of abnormal butters with characteristics approximating sometimes to those of margarine and sometimes to those of coconut fats has given rise to serious difficulties in expert examination and uncertainty in legal judgments regarding the purity of some specimens of butter. The authors aim at making it clear, by means of this note, that these difficulties have been exaggerated, and that the above fact alone does not suffice to render the reports of judicial experts unreliable. They especially insist that an industry of such utility and economic character as that of coconut butter should not be injured by proposing, as has been done, the « denaturing » and compulsory colouring of this food product.

Abnormal butters are of two kinds. In the first we have a decline of the saponification value and of the oleorefractometric deviation, and an increase of Hehner's (fixed fatty acids), Crismer's (critical dissolution temperature) and Hubl's (iodine) indices. They are made from the milk of decrepit, ill-fed cows, worn out with over-work and kept under bad hygienic conditions. In the second, on the other hand, there is found an increase of those indices which were reduced in the first, and a decline of those which had shown a rise. These are therefore contrasted manifestations, the only exception to which is the Reichert-Meissl value (volatile acids) which is found to be lowered in both cases. Those butters, the constants of which more closely approach coconut butter are in particular the result of feeding with beet leaves or with coconut cake.

A study of the data hitherto collected proves that the abnormal butters which may be mistaken for margarinised butters really form but a small minority. Thus in France for instance Vuaflart finds, among 1000 farm butters, 125 abnormal butters with an apparent proportion of margarine of less than 18 per cent. ; and among 100 dairy butters only 4 appeared to contain from 8 per cent. to 11 per cent. Dutch statistics state that for 1911, 8 per cent. of the butters posses constants which leave the question doubtful, and 1.69 per cent. may be regarded as margarinised in proportions varying from 15 % to 30 %.

As regards those butters which may be considered as adulterated by the addition of coconut butter, the authors point out that beet leaves, besides the property of modifying the constants of the butter in the direction of those of coconut oil, possess the antagonistic quality of com-

pelling the cows to consume their own fat and consequently give rise to changes of the constants in the opposite direction. That is why the result of analysis of a milk coming from cows fed on beet leaves, is contradictory according as one or the other phenomenon predominates ; the two may even neutralise each other. Feeding on coconut cake, which again cannot be kept up without injury to the health of the cows, except in a quantity not exceeding 2 lbs. per day, only introduces into the daily food ration 65 gr. of coconut fat per animal. Now the average daily production of butter being calculated at 600 gr, per cow, even if—as cannot be supposed—the whole of the cocount fat passed into the milk in this way, we should have an addition of this fat to the milk not exceeding 10 %. The number of samples therefore, giving abnormal results under analysis, from these three causes, must necessarily be limited. Those due to malnutrition and inadequate hygienic conditions come, in particular, from the north of France, Holland, and Belgium, more especially in the autumn, and as it is not in the interests of anyone to maintain conditions involving extreme danger to the health of the animal, there can be no question here of butter designedly abnormal for industrial purposes. These conditions will only prevail in those regions and in particular periods of the year, and may even disappear if speciul care is observed in stabling the animals. Abnormal butter due to feeding with coconut cakes might be mistaken for butter to which 8 per cent. of vegetable fat has been added ; now, putting on one side the fact that present methods are not so reliable as to give unequivocal indications below these limits, the interests of the dishonest trader are not met by so small an addition of vegetable fat, which might on the other hand be qualitatively detected even in a proportion of 2 per cent. by the optical method of Césaro and by that of Bomer based on the knowledge of the constants of phytosterin.

In conclusion, from the point of view of test by judicial experts, an abnormal butter really intended to deceive is an exception enclosed within narrow limits of origin, time and proportions, so as to render detection easy. Expert examination therefore loses none of its value, and the authors think that its dangers are frequently exaggerated, as a means of defence against experts predisposed to excessive severity.

1453 – **Control Butter.**

VUAFLART, L. Le Beurre de Contrôle. — *Annales des Falsifications*, No. 46, pp. 379-384. Paris, August, 1912.

In order to check the purity of butters the author advises recourse to a standard or control specimen obtained under attentive supervision during milking and subsequent operations.

In order to allow of a reliable comparison between the control but-

ter and the suspected butter, it is first essential to establish carefully the following points.

1. Has the butter originating from the milk of a single milking the same composition as that obtained by mixing the cream resulting from the milk of different days?

2. Does the cream directly after separation from the milk and that kept for several days yield an identical butter?

3. Have the preservatives to be added to the milk intended for conveyance to the laboratory any influence on the two operations of separating and churning and on the composition of the butter?

The object of the present communication is to make a first contribution to the study of these questions.

In order to compare the butter of a single milking with that of several milkings, the milk of 20 pasture-fed cows was taken; the cows received an additional ration of linseed cake to the amount of 2 lbs. per head per day. They were milked twice a day, and the milk was separated at once; butter was only made once a week. The following 8 samples of cream were taken; 1) mixture of cream of the night and morning of June 7; 2) similar mixture for the following day; 3) cream on June, 9, 10, 11, 13 and 14 from the morning and evening milk alternately; 4) a sample taken on June 13 from the mixture of all the creams, at the moment when put into the churn. Finally, after churning, a sample of the butter produced on the farm was taken.

The creams were put into the churn on the morning of June 14, and therefore the butters obtained in the laboratory are quite comparable with those obtained on the farm in point of time of keeping of the cream.

On subjecting the various butters to analysis. it was found that the farm butter was richer in volatile acids than all those prepared in the laboratory, including that resulting from a mixture of all the creams which should have been identical with that produced on the farm. In this connection it is needful to investigate whether this fact is due to difference in the method of churning. In any event the difference of one unit in the contents of soluble volatile acids is not very important, because on making the determination repeatedly on one and the same specimen of butter, differences of 0.4 and even 0.6 are found. Therefore if the suspected butter and the control butter show no differences greater than those now indicated, we must regard them as identical. An exception is, however, formed by the butter from the milk of the evening of June 12, for which the difference was 2.3, and which is much less rich than all the others in insoluble volatile acids and in the total of soluble acids; there is likewise a difference as regards Koettstorfer's index and the deviation in the butter refractometer; its colour was lighter.

In a previous study (1) on abnormal butters the author had pointed out that morning milk appears to give a butter richer in volatile acids than evening milk. The results of the above experiments and others made by the author have led him to the following conclusions. as to which he intends to make further researches:

1. The differences between the composition of butter made on the farm (with the mixture of cream) and that from the cream of a single milking or two milkings, are generally negligible. The greatest difference found for volatile acids appears to be 2.3, and if it were a question of making a trial the comparison would, if anything, be in favour of the maker.

2. Morning milk appears to yield a butter richer in volatile acids than that of the evening.

3. Keeping of cream over 8 days has no influence on the composition of the butter.

4. The action exerted on the composition of the butter by potassium bichromate, used as a milk preservative, is inconsiderable, and its influence seems rather to go in the direction of increasing the contents of soluble volatile acids. This cause of error would therefore tend to compensate that resulting from the fact that the control butter is derived from the cream of a single milking.

On condition therefore of not being over-strict in the examination of the figures, a suspected butter may legitimately be compared with the control butter from a single milking, with or without an addition to the milk of potassium bichromate, and whether or not churning is carried out immediately after separating. It should be noted however that the investigation for comparison cannot be reliable if not done very speedily. When the laboratory has to examine a suspected butter it should at once procure milk and cream on the farm from which the butter comes, and have the butter extracted; this, divided into three samples, would then be subjected to analysis together with the suspected specimen.

SUGAR INDUSTRY

1454 - **The Sugar Industry in Spain.** (2).

Rohr- und Rübenzuckerproduktion und- handel Spaniens 1911. — *Die Deutsche Zuckerindustrie*, XXXVII., No. 32, pp. 685-686. Berlin. August 9, 1912.

Sugar cane. — According to the last annual report of the General Direction of Excise, in 1911 the area under cane was about 4271 ha. (11 666 ac.) with a crop of 234 180 tons (3), making an average of

(1) See *Ann. des Falsific.*, 1912, No. 41, p. 121.

(2) For the sugar industry in Germany, France, Sweden, Hungary and Peru, see No. 403, *B.* Feb. 1912; No. 845, May 1912; No. 964, June 1912; No. 1093, July 1912; No. 1342, Sept. 1912. (*Ed.*).

(3) In this article "tons" means metric tons: 1 metric ton. = 0.9842 English ton. and 1.10231 U. S. ton.

49 tons per hectare. This unit average is exceeded in the important centres of Motril and Salobrega. However, both in point of weight and sugar contents the crop was deficient as compared with that of the preceding year; the reasons were the colds at the beginning of the year, and insufficient cultivation and manuring.

The cultivation of sugar cane in Spain has passed through a crisis, the economic consequences of which will still make themselves felt in coming years and restrict cane in favour of beet-growing. In 1911 moreover, owing to the low prices of sugar, the cane also fetched a poor price, *viz.* 24 to 27 pesetas (1 peseta = 9 ½*d.* at par) per ton of standing cane.

At the present time, the position as regards manufacturing plant is as follows:

	Sugar Factories		Macerators	
	Total	Working	Total	Working
Belonging to the Sociedad Central Azucarera.	11	7	13	10
Others	13	13	—	—
Total	24	20	13	10

In 1911 a co-operative sugar factory was established by cane growers at Olivar (Granada), with a daily treatment of 6 tons of cane.

The following are partial data in relation to manufacture:

	Macerated Cane tons	Sugar produced tons	Yield per cent.
1910	188 668	20 301	10.75
1911	234 181	20 295	8.66

The daily output was greater in 1911 in consequence of the lower yield, which made manufacture more rapid. Regrettable interruptions occurred in consequence of the shortage of labour and the bad weather.

Sugar beet. — This was grown in 1911 on 36 741 ha. (90 789 ac.) with an average crop of 21.55 tons (8 English tons 12 cwt. per acre). Generally, the crop was deficient in consequence of the exceptional dryness of the summer, and, in Aragon, likewise owing to a delay in sowing, due to differences as to price between growers and manufacturers. Beets fetched 35 to 40 pesetas per ton delivered at the establishments.

The existing sugar factories number 53, of which 37 belong to the "Sociedad Central Azucarera", 17 of these being at work. In 1910 another sugar factory was built by the above Company at Santa Eulalia (Teruel) with a daily treatment of 500 tons of beet. Other establishments, moreover, have extended their plant and others again will follow if the delimitation of the areas of purchase is carried out, a measure regarded as urgently needed in order to reduce general expenses.

With regard to manufacture, the following partial data are available:

	Beets treated	Sugar produced	Yield
	metric tons	metric tons	per cent.
1910	419 884	44 273	10.54
1911	676 092	68 040	10.06

Difficulties were encountered both owing to irregular deliveries of beets and deficiencies in the machinery.

Growth of Total Production. — This may be summed up in the following table:

Beet Sugar				Cane Sugar				Total Sugar including Sorghum		
Season	Beet treated	Sugar produced	Yield	Season	Cane treated	Sugar produced	Yield	Season	Sorg. sugar	Total prod.
	tons	tons	per cent.		tons	tons	per cent.		tons	tons
1901-02	553 336	51 263	9.26	1901	295 403	27 998	9.47	1901	112	87 619
—	—	—	—	—	—	—	—	—	—	—
1910-11	483 427	62 363	12.90	1910	188 668	20 301	10.76	1910	—	91 365
1911-12 *	676 092	68 040	10.06	1911	234 181	20 295	8.66	1911	—	106 424

* To Dec. 31, 1911.

The maximum total production was attained in 1908 with 122 339 tons, corresponding to a maximum treatment of 978 437 tons of beet and with a corresponding maximum production of beet sugar represented by 113 917 tons, which took place in the 1907-1908 season. The maximum production of cane and the corresponding cane-sugar occurred in 1905 with 309 152 and 28 520 tons respectively. The production of sorghum sugar, after reaching 152 tons in 1902, does not appear from 1904 onwards.

The greatest centre of production is the province of Granada, with 19 factories and an output in 1911 of 10874 tons of cane-sugar and 30 835 tons of beet sugar; Saragossa follows with six factories, and a production of beet-sugar of 23 308 tons; in the remaining provinces the output ranges from 500 to 8 000 tons.

For the bye-products we have:

	1910	1911
	tons	tons
Glucose	1 949	1 917
Molasses	38 081	34 712

Market. — As compared with the minimum consumption in the last decade which occurred in 1902, the maximum took place in 1910, *viz.:*

	tons
1909	87 690
1910	120 247
1911	117 693

The available stocks at the end of the year were respectively:

	tons
1909	114 823
1910	94 553
1911	83 274

Exports and imports are negligible. Noteworthy is the exportation in 1911 of 1 480 tons of crystallised fruits and produce and 9 199 hectolitres of liqueurs, as against imports of 77 tons and 909 hl. respectively.

The average prices of sugar during the last five years (Barcelona) were:

	Beet Sugar		Cane Sugar	
	centrifugalised	granulated first	centrifugalised	« Blanquillo »
1907	102.60	107.80	106.86	107.35
1908	114.94	118.44	114.74	118.53
1909	115.36	120.45	119.65	119.73
1910	113.17	118.05	117.37	117.79
1911	96.70	100.75	99.77	99.25

Duties. — During the last 10 years a continuous increase of the yield of the sugar tax took place; thus we have:

	Pesetas
1902	21 680 206
1910	38 893 306
1911	41 722 889

Article 2 of the Law of 3rd August 1907, prohibiting the establishment of new sugar factories and the extension of those existing, was abolished by a Decree of 12th June 1911, the import duty being at the same time reduced from 85 to 80 pesetas per 100 kg.; the manufacturing duty remained unchanged. The General Direction of Excise has taken over the monopoly of saccharine, fixing the price at 25 pesetas per kg.

WINE-MAKING

1455 - **Influence of the Fermentation Temperature on the Qualities of Red Wines.**

MATHIEU, L. Influence de la température de cuvaison sur les qualites du vin rouge. — *Revue de Viticulture*, 19th Year, Vol. XXXVIII, No. 976, pp. 237-241. Paris, August 29, 1912.

An experiment made by the author in 1911 proves that fermentation at low temperatures produces in red wines, just as in white ones, a finer and more intense bouquet, which appears to be due to the nutrition of the yeast itself; it further demonstrates however that attention must be given to maceration which, at low temperatures, would be insufficient, and it must be directed so as to be as complete as possible. The ideal would even be to avoid having to concern oneself with maceration during fermentation by carrying out the two operations separately.

Endeavours made in this direction to separate maceration from fermentation, but from other points of view, have for that matter already been successfully accomplished, by industrial means above all; Dr. Prunaire had, in 1877, directed attention to the hot maceration of the lees as a means for colouring wines. M. Rosenstiehl, when sterilising, carries out preliminary hot maceration, which is certainly one of the most important factors in the success of the red wines on his method. The author had, in 1904, recorded the encouraging results of a previous maceration of the skins in hot must carried out in a simple boiler.

M. Bioletti conducted a series of experiments in California, in 1905 and 1906, which led to hot maceration with immediate separation of the must and cooling, in order to ferment afterwards at a maximum of 32°, a process which he applied from that very time in California.

M. Barbet has recently effected preliminary maceration by means of a battery of macerators with sulphured must. M. Semichon, in September 1909, advocated maceration subsequent to fermentation of the juice extracted clear by running off and pouring on again.

Unfortunately, maceration by heat requires an extensive plant supplemented by a cooling plant, which can only find room in considerable installations; nevertheless, with the facts which have now been ascertained, the author does not think it impossible to carry out by fairly simple means the two *desiderata* which rather tend to be mutually exclusive: - fermentation at low temperatures and perfect maceration - in the smallest concerns.

1456 - **The Qualities necessary for Yeasts and the Use of the Latter in Wine Manufacture.**

MARTINAND V. Des qualités que doivent présenter les levures et de leur emploi dans la vinification. — *La Revue de Viticulture*. 19th Year, Nos. 974-975, pp. 177-183 and pp. 210-219, Paris, August 15 and 22, 1912.

The writer shows that yeasts for wine-making should be grown in a medium which provides them with an excess of nutritive substances. This excess is used for the continued nutrition of the cells and their increase. Maltose is, according to the experiments of Lindner and those of the writer, more easily assimilated than other sugars by wine yeasts. This assimilation is followed by rapid multiplication, as is shown by the turbidity produced in the liquid and which increases continually without giving rise to fermentation. Beerwort is thus specially suitable for this kind of culture. Further, commercial yeasts, brewing, baking and distilling yeasts all have barley malt as their principal raw material. The generic name of yeast, by which is meant cultures of wine ferments in beerwort, is here particularly justified.

The bouquet given to wines by the yeast is limited to the process described by Erlich. All the properties of flavour are due to reactions produced by the polyphenols of the wines, the air and their oxidizing diastase, as well as to the natural scents contained in the grapes themselves. *Mycoderma vini* (flowers of wine) is the chief destroyer of the flavour-producing elements of wines, so its development in the must and the wine should be prevented. Further, the name *Mycoderma vini* includes a number of species of these micro-organisms of very different characteristics. The study of this subject would be very advantageous to wine-manufacture.

It is often well to use a mixture of yeasts, rather than one kind, in starting fermentation in the wine.

It is impossible to generalise as to the yeast best for different wines.

Some wines which have little alcohol and are made from grapes grown at an altitude exceeding 1 000 feet, are best if allowed to ferment naturally by means of the apiculated ferment which they contain, to the exclusion of elliptical ferment. In other cases, contrary to the opinion of many French wine-manufacturers, the use of cultivated ferments is necessary, since the grapes, especially if grown on the plain, contain none, or almost none, while they are plentifully supplied with other micro-organisms, which do not lead to good fermentation.

The use of sulphurous acid is necessary in wine-making in order to get rid of micro-organisms (especially those bacteria which produce stable acids with sugars and volatile acids with alcohol) and to carry out the process in a satisfactory manner, so that the wine keeps its freshness and colour, and to retard its becoming old, however long it remains in the cellar.

A well-made wine, treated with yeast and sulphurous acid, contains combined sulphurous acid and even free sulphurous acid derived, after fermentation, from the combined acid. This free acid protects the wine from all change, but has the inconvenience of disappearing when it is transformed into sulphuric acid by racking, which sets up a slight fermentation.

If the wine still contains sugar, this fermentation renders it sparkling, but does not cloud it in any way. This wine, on exposure to the air, ought not to become covered with *Mycoderma vini*, even if the little sulphurous acid present disappears.

The addition of ammoniacal salts to the vintage and the must should be omitted for the folllowing reasons: 1) for fear of rendering the wine bitter; 2) to avoid the diminution or suppression of all the flavour due to the development of the ferment. On the other hand, phosphoric acid is a necessary element of alcoholic fermentation, according to the researches of Harden and Young and of Lebedeff. It can be used in combination with sulphurous acid.

In conclusion, the writer has given a short method for analysing the yeasts of commerce, based on ascertaining the purity of the culture liquid and the vitality of the cells which it contains.

1457 - Rose-coloured Wines.

Roos, L. Vins Rosés. — *Revue de Viticulture*, 19th Year, Vol. XXXVIII, No. 972. Paris, August. 1, 1912.

The production of rose-coloured wines and also of grey and pale wines, which greatly resemble them, was formerly confined in France to two or three districts, where they were much appreciated. Now a-days, very large quantities are made in the chief centres of production.

The consumer of rose-coloured wine requires a combination of rosy colour with the usual qualities of white wines. Thus it follows, that the technique of white wines only must be considered when it is a question of producing rose-coloured ones. The most simple method of obtaining a rose-coloured wine is by colouring a white one by blending with a small quantity of red wine. This proceeding is not objectionable or illegal, and the rose-coloured wine obtained in this manner, and made well from good white grapes is much superior to that derived from common black grapes.

Another method is to treat a mixture of white and black grapes in the same manner as white ones, the black being more or less coloured.

The must, which is obtained by crushing and pressure, is rose coloured, the depth of colour depending upon the proportion of black grapes used in the mixture. The liquid retains its rose colour after fermentation.

The usual method consists in treating ordinary black grapes like white ones without more speed or precautions. Under these conditions, the must which is obtained without artificial pressure is of a very light rose colour, while that which is pressed out is darker, and a mixture of the two gives the desired tint. This is very similar to the manner in which white wines are obtained from black grapes, and as it is very difficulty to obtain quite colourless wines, it is possible that the number of rose-coloured wines on

the market, and consequently their increased consumption, may be due to the failure of many vine growers to make white wines from black grapes.

Further, as the difference in taste between a red wine and a white one made from the same grapes depends on the method of fermentation and the presence or absence of the solid portions of the fruit, it is easily understood that by carrying out the fermentation process of the complete red vintage and by reducing the number of hours during which the liquid and the residuum are in contact, rose-coloured wines can also be obtained. These short time wines have long been made in the south. They are called "one night wines" if the fermentation is limited to twelve hours, and "twenty-four hours wines" when it is prolonged to a day and a night. These wines are very fine and resemble white or rose-coloured wines, being, however, deeper in colour than the latter.

A rose-coloured wine, to find favour in the eyes of consumers, must contain sufficient alcohol, not less than 9 to 10 per cent., and be of a bright rose colour very slightly tinted with yellow.

When sulphurous acid is used in wine-making, it must be remembered that it dissolves the colouring matter, which reappears when the acid has been eliminated by evaporation or transformation.

Thus, in order to obtain white wine from red grapes, it is necessary to prevent any contact between the sulphurous acid and the grape skins, *i. e.* with the organs where the colouring matter is localized, while if rose-coloured wine is required it is necessary, on the contrary, to promote such contact. An addition at the rate of 6 ounces of sulphurous acid per 100 gallons of wine, to the grapes at the moment of crushing, the action of which continues during the formation of the must due to the pressure of the grapes upon each other, ensures a good deal of the colouring matter being dissolved, which will be proved by the decided colour of the wine made. An addition of a quarter or of a third of the above quantity of sulphurous acid per hectolitre of must separated from the residuum is quite sufficient to retard the beginning of fermentation for 24 to 36 hours and to allow of settling, thus producing an excellent white wine.

Rose-coloured wines produced by any of the above-mentioned methods are wines in the legal sense of the word, *i.e.* they are the product of the juice of fresh grapes. They are not, however, white wines, on account of their colour, and they differ from red wines in taste and composition. How then are the results of their analysis to be interpreted ?

The Advisory Committee of the arts and manufactures of France has given as the quotient of the division of the weight of alcohol per litre by the weight of dry extract 4.50 for red wines, 6.50 for white; above these figures the wines are to be presumed to have had alcohol added to them; but nothing is said with regard to rose-coloured wines.

It is possible to obtain a whole scale of wines made from the same vintage of red grapes of which the extreme limits would be certainly types characteristic of white and of red wines, but each of the intermediate wines would be very difficult to distinguish from the one preceding or following it as regards slight differences of taste, shade and composition.

There would thus be in this scale one end to which the limit of 6.50 fixed for the white wines would apply, and one corresponding to that of 4.50 determined for the red, but between them would come a whole series, which could not logically be judged by either the one or the other estimate.

Hence the necessity that other means of estimation should be fixed.

COLD-STORAGE INDUSTRY

1458 - **The Refrigerating Industry and the Preservation of Perishable Commodities in Russia.**

SOSKICE, D. La conservation par le froid et l'avenir économique de la Russie. — *Revue générale du Froid*, 4th Year, No. 39, pp. 459-474. Paris, August, 1912.

In Russia the use of natural ice for the preservation of perishable commodities is usual and general. Each family has its own ice safe or pantry; nevertheless the use of enormous industrial refrigerators known as "Kholodnick", "Morozilka" or "Vikhod" undergoes extension day by day; they are used for salting and freezing fish. There are also a large number of cold-storage cars for the conveyance of eggs, butter, poultry and salt meat, and also depots in the railway stations for replenishing the cars with ice. These depots are found in the fishing centres, on the shores of the Caspian Sea, the Sea of Azov, the Black Sea, and the centres of the Volga and the Don. The ice house is a half subterranean construction with walls of natural ice about 3 metres thick; its capacity attains 1 750 000 and even 2 000 000 cubic feet and the ice contained is at times sufficient for replenishing 4000 cars. Other improved ice houses comprise several departments for freezing, depots for frozen fish and reservoirs intended for the reproduction of the fish. A mixture of salt and pounded ice is used for maintaining the temperature in the freezing chambers below zero, while the rooms intended for the preservation of already frozen fish are kept at temperatures of -6° and -11° C. Freezing and storage of the fish for 9 months cost about £ 1 15s per ton. The shortage of refrigerating cars required for the transport of frozen fish suggests a special packing. Each fish, frozen whole, is wrapped up separately in oil paper and then in ordinary paper; afterwards all the fish are piled in layers in barrels. Between each layer sawdust is placed, and finally the barrel is in turn put up in a sack of coarse cloth. This packing, which allows of keeping the fish frozen for four or five days, costs 24s. per ton.

For butter likewise there are various large depots of natural ice. The most extensive of all is that in the new port of St. Petersburg; it

can preserve 850 tons of butter. The butter comes from Siberia; the number of special cars running on Siberian lines is to-day 1444. The Siberian railways have also established 160 natural ice depots for the replenishment of cold-storage cars during their journey.

The artificial refrigeration industry only possesses 200 machines distributed through 167 installations, of which 37 are on board ship, belonging mostly to the Navy. Of the other 130 there are 4 in Turkestan, 6 in Siberia, especially in the Far East, and 11 in the Caucasus; all the remainder are in European Russia.

The number of installations exclusively intended for the preservation of perishable commodities does not exceed 12, which work almost exclusively for export. The largest installation of this kind, the Union Cold Storage Company Ltd., belongs to English owners. It is on the banks of the Dvina, at Riga, so as to be accessible to the cold-storage steamers which carry on the service between London and Riga. It is principally used for the storage of eggs and poultry and has a capacity of 250 000 cubic feet.

The principal port for the exportation of butter is Windau; the butter arrives here from the different centres of milk production in Siberia, in cold-storage cars, and is carefully put up in straw wrappers. The butter depots at Windau have a capacity of about 5000 tons. The eggs come from European Russia, chiefly from the regions of Kourgan and Goronezh; their port of shipment is generally Riga. The progress made in regard to the exportation of butter during the last twelve years is clearly evident from a table which supplies the following figures:

Exportation:	1899	1910
Butter	20 000 000 fr.	132 000 000 fr.
Eggs	76 000 000	167 000 000
Poultry	21 000 000	36 000 000

In 1894 the exportation of butter was only 7 tons.

The transporting capacity of the Russian cold-storage cars does not exceed a thousand tons, while the large Russian markets alone require at least three million tons. The total capacity of the cold-storage depots is only 16 000 tons, while perishable commodities which would need to be stored are estimated at a million tons.

The development and progress of the industry of cold in Russia has therefore become a matter of urgent necessity. A substantial loss of money arises from the fact that the meat needed in St. Petersburg and Moscow is forwarded there in the form of live cattle, and that the fish caught on the coast is sent to the interior frozen and salted. On the other hand the Caucasus, the Crimea and Southern

Russia, owing to the want of cold-storage installations and transport, are unable to give the market of the interior the benefit of the great variety of fruits of the best kinds which they have at their disposal.

In 1911 two Companies were formed in Russia in order to put the industries of meat, fish and fruit on a more modern basis; the Government recognises the necessity of securing progress in the refrigerating industry in Russia; it sends official representatives to the International Cold-storage Congress and encourages all the initiatives which tend to propagate the use of artificial cold.

The following is the information gathered by the *Revue Générale du Froid* (p. 481) with regard to this movement of progress.

The Belgian Consul General at Kharkof reports that various schemes for the consideration of cold-storage depots will be shortly carried into execution at many points of the Russian Empire. Covered markets provided with cold-storage plant will be built at Kharkof, Rostof (on the Don), Nakhchevan, Stavropol (Caucasus), Piatigorsk (Caucasus), Sevastopol, Yaroslaf and Kostroma.

The cities of Baku, Batum, Moghilef and Reval are each preparing a scheme for the construction of abattoirs with refrigerators. The city of Archangel proposes to build a large cold-storage depot for frozen fish.

The Society of Horticulturists and Fruit Merchants has prepared a scheme for the construction of cold-storage depots in Astrakhan. This city is an important centre of exportation of fresh fruit to the Russian interior market; it receives great quantities of fruit from Persia, Central Asia and the Caucasus.

PLANT DISEASES.

DISEASES NOT DUE TO PARASITES AND OF UNKNOWN ORIGIN.

1459 – **The "Zapal" or "Zakvat" of Cereals in Russia.**

VASSILIEV, T.: O Zapalye ili Zakhvatye Khlebnykh Rastenii. — *Khozaistvo* (The Farm). Year VII, No. 26, pp. 864-872; No. 27, pp. 903-909. Kiev, July 1912.

A disease of cereals known in Russia under the name of "zapal" or "zakvat", every year causes enormous losses in the south-eastern provinces of the Russian empire. According to the calculations of Moraev, in the Government of Kuban alone the yearly damage involves fully 3 226 860 quintals, made up of wheat, barley and oats, and representing an aggregate value of some forty million francs. In the north Caucasus the harvest is reduced by 20 per cent., and in Povoloxia (Government of Saratof) a loss of 30 to 50 per cent. is often reached. This is, so to speak, the normal condition, because in bad years the crops are literally destroyed, and famine descends upon extensive and densely populated regions. Notwithstanding the imposing proportions of this scourge, however, nothing has yet been done to keep it in check, and very little is known as to its essential character. "Zapal" usually begins to rage after the appearance of dust-laden fogs carried by the south-easterly winds and known by the names of "mgla" and "pomokh". The tissues of the plants rapidly discolour, whitish-yellow spots and stains appear on the leaves and culms, the caryopses, as soon as they form, dry away and die. In the present article the author makes a detailed study of the disease. What is, in the first place, he enquires, the real relation between the "zapal" and the dust clouds ("mgla")?

On the 8th. of July 1904, writes Pulz, the buckwheat was in full flower when the fogs made their appearance. A single day sufficed to bring about the fall of a large portion of the flowers and the withering of the leaves and young branches; these alterations were due to the dry wind which always accompanies the fogs and which, owing to the exceedingly rapid loss of moisture, leads to the death of the tissue. Bonderiev asserts, on the contrary, that "zapal" takes its origin from the existence of innumerable spores of fungi which the winds bring from Asia, and

he likewise points out that in reality the fogs are generally followed by attacks of cryptogamic diseases on a very large scale. The hotbed of infection, says Bonderiev, must be sought in the wild gramineous plants which form a principal part of the steppe flora of Central Asia. This would likewise find confirmation in the following words of Morev: " If by zakvat (= zapal) is meant that phenomenon by which barley and oat plants, already well grown, yield ears and panicles which are empty or have poorly grown caryopses, then it may truly be said that zapal is not caused by the dry winds but simply and exclusively by *Puccinia*. But zapal can in a few hours convert an ear or panicle which is fine and thick with caryopses, into a light and empty one with such rapidity as to preclude *a priori* any biological cause, whether insects or cryptogamic diseases ".

The author reports numerous examples and supplies copies of particulars which would tend to show that " zapal " is due, on the other hand, to the effect of unfavourable meteorological effects, such as dry wind, alternating drought and rain, etc. The most important conclusions drawn by the author are :

1. The " zapal " of cereals is a very frequent phenomenon in the southern provinces of the Russian Empire and is intenser as we proceed further east.

2. This phenomenon accompanies or follows the dust fogs driven by south-east winds (fogs termed " mgla " when the dust is exclusively mineral, and " pomokh " when it is mixed with organic remains, fungal spores, etc.).

3. " Zapal " is generally accompanied by a high temperature and relatively low moisture in the air, these being conditions which may occur likewise without the intervention of dry winds.

4. The cause of " zapal " is therefore exclusively to be found in weather elements : high temperature, little moisture in the air, heavy insolation, fogs, etc. Severe attacks by insects or cryptogamic diseases are not the cause, but an effect of " zapal ", which renders the plants less resistant.

5. The harvest is very much damaged both in quantity and quality, the losses sometimes amounting to 50-60 per cent.

The external appearance of the caryopses, small and misshapen, is likewise bound up with alterations of composition (a higher percentage of cellulose and ash) which make them far less nutritious.

7. Nothing has as yet been done to control the evil.

The problem deserves to be studied with the utmost attention, both by investigations and statistical records on the spot to determine the conditions in which " zapal " takes place and the character of the damage,

and by experimental methods with laboratory investigations for the purpose of ascertaining the action of weather factors, separately or in groups, producing artificially the appearance of " zapal ".

1460 – A Panicle Disease of Rice.

NOVELLI, N.: Del rachitismo del riso. — *Il Giornale di Risicoltura*, Year II, No. 15, pp 226-228, 1 fig. Vercelli, August 15, 1912.

In the province of Pavia, Italy, there was found a specimen of " Chinese originario " the panicles of which, sustained by culms of poor growth, were short and very stumpy. Around the branches of the panicle, likewise short, very stunted spikelets, almost round and slightly flattened at their apices, were grouped. The glumes, covered with fine down, presented externally the characteristic streaks of the " Chinese originario ", the appearance of which was likewise retained by the caryopses, though they were very small, stumpy and deformed, with blackish pericarp, and internally whitish like common rice. The embryo appeared extremely small and misshapen.

Out of 170 of these caryopses sown only 7 germinated ; the resulting plantlets grew poorly and yielded panicles and caryopses which reproduced, though in a less pronounced form, the above deescribed anomalies.

The author afterwards met with the same phenomenon in two " Ranghino " plants. He intends making further investigations, but meantime is of opinion that the phenomenon is to be attributed to special derangements in the assimilative functions of the plants leading to an arrest of growth at a given moment.

1461 – Bruise in Potato.

HORNE, A. S.: Contributions from the Wisley Laboratory. XVI. in *Journal of the Royal Horticultural Society*, Vol. XXXVIII, Part I, pp. 40-50, figs. 20-21. London, July 1912.

During the last few years a large number of potato varieties have developed a disease characterised by the black colour acquired by the flesh of the tuber as though due to a bruise ; this colour becomes still more pronounced after the crop has been stored for a time.

Experiments undertaken in this connection by the author have made it clear, however, that under favourable conditions of climate and soil there is obtained from the diseased potatoes a perfectly healthy crop, and that the disease is not transmitted from one tuber to another. In the portions of the tissue of the potato recently attacked by bruise, diseased and sound cells are found intermingled. The first *postmortem* change observed in a diseased cell is an alteration of the index of refraction ; further, the protoplasmic movement is no longer observed in them, while it is still evident in the adjacent living cells. No formation of a cicatrising cambium takes place between the diseased and the healthy tissues as

occurs with tubers affected by " Internal Disease ", " Streak Disease " (1) or by *Phytophthora*. No fungus mycelium was found either inside the cells attacked or in the intercellular air passages, nor yet were any bacteria identified inside or around the recently diseased cells. With Mandelin's reagent (1 part of ammonium vanadate in 1000 parts of a mixture made up of 98 parts of concentrated sulphuric acid with 36 parts of water) and Brandt's reagent (3 grammes of sodium selenate in a mixture of 8 cc. of water and 6 cc. of concentrated sulphuric acid), the relatively large quantity of solanin contained in the diseased tissues as compared with the healthy ones was made evident. It must be held that the disease under investigation is fundamentally of a physiological origin. If this is so in reality it may still be cured and its occurrence may be prevented by modifying or improving the conditions of cultivation of the potato. Further investigations as to the behaviour of the malady are still required.

1462 – **Enquiries into Chlorosis in Plants induced by Carbonate of Lime.**

MAZÉ, P., RUOT and LEMOIGNE.: Recherches sur la chlorose végétale provoquée par le carbonate de calcium. — *Comptes rendus hebdomadaires des séances de l'Académie des Sciences*, Vol. 155, No. 7 (August 12, 1912), pp. 435-437. Paris, 1912.

On the basis of the physiological consequences which follow when maize is deprived of sulphur or iron (2), the authors proposed to reproduce experimentally plant chlorosis as manifested in lime soils, and to determine its true cause.

The introduction of calcium nitrate as a nitrogenous food into the nutritive solution, and the addition of doses increasing from 0.5 to 2 per thousand of calcium chloride together with insoluble calcium carbonate, forms a medium resembling chalky soils, because in both cases the liquid in contact with the roots contains calcium bicarbonate. In a medium of this kind maize retains its green colour, but its growth is made very slow in consequence of the excess of calcium chloride. Maize, well adapted for calcareous soils, therefore does not become chlorotic in a medium surcharged with lime salts.

White lupin becomes chlorotic after remaining for a few days in solutions with an addition of calcium carbonate. Its aerial parts remain green in solutions free from carbonate, notwithstanding that the latter contain calcium nitrate and chloride. Chlorosis of white lupin therefore is produced by calcium carbonate.

As the growth of lupin in artificial media is very precarious, the authors, in order to carry out the tests regarding the determination of the

(1) See p. 158, *B.* Nov. 1910. (*Ed.*).
(2) See No. 223, *B.* Jan. 1912. (*Ed.*).

mechanism of chlorosis (tests which consist in evaporating on the leaves drops of a solution of 0.2 per thousand of ammonium sulphate and ferric nitrate) had recourse to *Vicia narbonensis*. This leguminous plant grows well in the following solution :

Calcium nitrate	1 gr.
Potassium bisulphate	0.25 gr.
Ammonium sulphate	0.20 gr.
Magnesium sulphate	0.05 gr.
Ferrous sulphate	0.025 gr.
Potassium silicate	0.025 gr.
Aluminium sulphate	0.025 gr.
Calcium chloride	0.120 gr.
Manganese chloride	0.025 gr.
Spring water	1000 gr.
Soda	Sufficient to neutralise the solution as tested by litmus.

If calcium carbonate is added to the culture solution at the rate of 2 per thousand, the plants become regularly chlorotic after producing half a dozen normal leaves.

Drops of solution of ferric nitrate at 0.2 per thousand deposited on the discoloured leaves cause the appearance of chlorophyl after three days ; magnesium sulphate does not exert any action on this chlorosis. It is therefore the calcium carbonate which has produced the chlorosis by the withdrawal of iron.

The explanation of the phenomenon is as follows : In the foregoing media supplied with calcium carbonate the iron is made entirely insoluble. Certain plants like maize possess the property of absorbing it by means of the acid secretions of their roots (malic acid in maize). Other plants like lupin and *Vicia narbonensis*, less capable of producing a sufficient quantity of acid, cannot act on the insoluble iron and become chlorotic.

French vines behave like maize in calcareous soils ; American vines, like lupin or *V. narbonensis* ; the absorption however of excessive doses of calcium bicarbonate has no connection whatever with the evil.

Using ferrous sulphate empirically as a remedy against chlorosis, the cause of the disease is attacked direct, and to get at it more effectively the iron is conveyed into direct contact with the tissues of the plant instead of being administered to the roots, which are too often incapable of absorbing it.

BACTERIAL AND FUNGOID DISEASES.

GENERALITIES

1463 - **First International Congress of Comparative Pathology.**

Der erste internationale Kongress für vergleichende Pathologie. — *Zeitschrift für Pflanzenkrankheiten*, Vol. XXII, Part 6, pp. 383-384. Stuttgart, August 3, 1912.

The first International Congress of Comparative Pathology will be held in Paris, from the 17th. to the 23rd. of October 1912, in the halls of the Faculty of Medecine, under the presidency of Prof. Roger, professor of experimental and comparative pathology. This Congress will deal with human and animal diseases from all points of view, and with the relations existing not only between the several groups of diseases of the animal organism but likewise those obtaining between diseases of plants and animal diseases. Prof. Matruchot will preside over the section of Plant Pathology.

FUNGI

1464 - ***Cystopus candidus* on *Lepidium latifolium*.**

NOFFRAY, E.: Le *Cystopus candidus* sur le Passerage à larges feuilles (*Lepidium latifolium*) *Journal d'Agriculture pratique*, 1912, Vol. II, No. 31, pp 147-148. Paris, August 1, 1912.

The invasions of *Cystopus candidus* on Shepherd's Purse (*Capsella Bursa-pastoris*) which are reported as causing injury in the vicinity of kitchen gardens and fields in which cruciferous plants are cultivated, are exceeded in virulence by those to which *Lepidium latifolium* is subject. This crucifer is much rarer than *Capsella*, so much so that by some authors it is regarded as a naturalised plant rather than spontaneous; nevertheless, owing to its stoloniferous habit it is abundantly represented wherever it grows. *Lepidium latifolium* lives by preference around dwellings, in the vicinity of kitchen gardens, in waste places around the latter, and sometimes likewise on the borders of cultivated fields.

The author, having laid stress upon the little known property of this plant of serving as an excellent hotbed of infection for *Cystopus* in relation to cultivated crucifers, recommends that the *Lepidium* should be carefully destroyed as soon as its appearance is observed.

1465 - ***Lophodermium nervisequum* parasitic on Leaves of Silver Fir.**

MER, EMILE. Le *Lophodermium nervisequum* parasite des aiguilles de sapin — *Revue des Eaux et Forêts*, Vol. 51, No. 16, pp. 481-493. Paris, August 15, 1912.

The writer had previously shown that *Lophodermium macrosporum* (1), parasitic on the leaves of the Norway spruce (*Picea excelsa*), exhibits in the Haute Vosges different behaviour from that which, according to the descripions of R. Hartig., it shows in some mountainous regions of Ger-

(1) See p. 166, *B.* Nov. 1910. (*Ed.*).

many; he therefore wished to ascertain whether *L. nervisequum* on silver fir (*Abies pectinata*) also showed differences from its habits noted by Hartig in the Erzgebirge, and in the plain of Neustadt-Eberswald.

From the investigations made it results:

1. That the activity of growth of the parasite is closely bound up with the food it finds in the host leaf.

2. That the resistance of the leaf to the attack of the fungus is largely influenced by the quantity of the starch reserve at the disposal of the leaf.

Thus, in silver fir, as in spruce, a young leaf with good insolation on a vigorous branch, withstands the infection, while another of average vigour is open to attack. The fungus, finding sufficient nutriment in the leaf at the moment of attack, or even later, invades it entirely or in part and sends out sooner or later its normal fruit-bodies. Finally, when the leaf begins to wither, its resistance to the fungus grows exceedingly feeble, but the latter finding in it an extremely meagre food supply grows slowly and imperfectly. The leaf finally falls by the same mechanism as all silver fir leaves which have reached the last stage of growth. When fruit-bodies form on the fallen leaves, which is more rarely the case with silver fir than with spruce, they are rudimentary. Both species of *Lophodermium* propagate themselves almost exclusively on the lower slow-growing branches, even when these branches belong to vigorous trees. In trees of very defective growth, the entire crown may be invaded, though in different degrees according to the level and age of the leaves.

The form of *Lophodermium macrosporum* which lives on the fallen leaves in the Vosges is much more frequent than that which grows on the leaves attached to the branches. The contrary happens with *Lophodermium nervisequum*, at least in the case of the silver firs which have exceeded their tenth year. The reason is as follows: In both species of trees it is chiefly the weakened leaves which fall victims to the infection; as the low branches of spruce suffer more than those of silver fir from the shade produced by the upper branches they are frequently affected at the age of 5 to 6 years. Consequently, their leaves fall in great abundance during the autumn, both from isolated trees and still more from those in dense stands. The leaves of silver fir on the contrary, less exacting in point of insolation, are better able to withstand the shade thrown by the upper branches. Thus *Lophodermium nervisequum* rarely attacks them on isolated trees. With regard to silver firs in groups, the lower branches are chiefly attacked between the ages of 20 and 40. In stocks of silver fir, it is chiefly that form of *Lophodermium nervisequum* which grows on the leaves adhering to the branches which can be observed throughout the year in its various stages of development; the form on the fallen leaves is on the contrary transitory (September to October), and less frequent. Contrary to what

happens in silver firs over 10 years, the young ones up to the age of 8 to 10 are frequently assailed by this latter form, especially when they are in poor soil beneath a rather dense shade and fairly close to each other; these conditions (which taken together retard the vital activity of the plant and increase the inactivity against the parasite) are encountered chiefly in the seed-beds which form spontaneously beneath stocks of trees insufficiently thinned out, and mainly where regeneration fellings are conducted; and in the second place in the small temporary nurseries or "placeaux" which are laid down where perhaps no tree exists, or at points without much shade, in order to cultivate plants intended for transplantation to surrounding open spaces. The author observed this latter case in the forest of Gérardmer which is made up of silver firs and spruces; he ascertained that the poverty of the soil was the principal cause of the poor growth of the young trees and consequently of their infection, which he endeavoured to control by means of fertilisers. From the experiments carried out, it was found that quick-acting chemical fertilisers (nitrate of soda, sulphate of ammonia and chloride of potash) did not increase the vigour of silver fir and spruce saplings; thus for instance nitrate of soda applied to young silver firs in amounts of less than 10 grams (about ⅓ oz.) proved ineffective; from 12 to 15 gr. (about ½ oz.) were injurious; while 15 to 20 gr. (½ to ¾ oz.) were fatal. Several leaves of the plant subjected to experiment further showed the first signs of infection due to *Lophodermium*. On the contrary, slow acting organic manures (old stable manure and vegetable earth, peat, or if the latter is wanting, leaf mould of beech, maple, etc., in a homogeneous mixture with slag and potash salts) are those which in point of efficacy and economy are best adapted to resinous forest stands. It is therefore advisable always to have ready and in preparation near nurseries, heaps of mould to be spread as a preventative over the area of forest intended to be covered with trees. The use of good mould will afford the certainty of obtaining plants made immune by their own natural vigour against the attack of *Lophodermium*.

RESISTANT PLANTS

1466 - **Resistance of *Coffea liberica* and *C. canephora* to *Hemileia* and other Diseases in Madagascar.** — See above, No. 1422.

MEANS OF PREVENTION AND CONTROL

1467 - **The Most Suitable Means for Controlling Bunt and Smut in Wheat.** FUSCHINI, C. Dei mezzi più idonei a combattere la "carie" ed il "carbone" del frumento (1). — *Le Stazione Sperimentali Agrarie Italiane*, Vol. XLV, Part 8, pp. 549-586. Modena, 1912.

The author has undertaken researches in the Royal Superior Institute of Experimental Agriculture at Perugia in connection with the most effective means of control of wheat diseases.

(1) See No. 236, *B.* Jan. 1912. (*Ed*).

Experimental investigations limited hitherto to bunt (*Tilletia Tritici*) and smut (*Ustilago Tritici*) have yielded during the first four years the following results:

1) For bunt, solutions of sulphate of copper ½ per cent., formaldehyde 1 to 2 per thousand and lysoform 3 per cent., used for treating the grain for sowing, are thoroughly effective. It is however necessary to bear in mind that for the use of sulutions of sulphate of copper the most practical and most effective method is the following: A solution of sulphate of copper in water, ½ per cent. strength, is prepared and is put into one or more wooden vessels, vats, tubs, etc., in such a way however that in each vessel not more than one half of its volume or capacity is occupied. Simultaneously in separate vessels milk of lime is prepared by slaking lump lime at the rate of 1 lb. per gallon of water. When this is done, the wheat is emptied into the vessels containing sulphate, and the mass stirred up with a stick for about 15 minutes, after which it is dipped for a few seconds into the milk of lime in order to neutralise the acidity of the sulphate of copper. For the use of solutions of formaldehyde the same method is used as is adopted for sulphate of copper. Submersion must last at least half an hour. Subsequent treatment with milk of lime is not necessary. For the use of solutions of lysoform, what has been said with regard to formaldehyde holds good; the dip however must be limited to a quarter of an hour.

2) Against smut none of the preventive treatments hitherto contrived has proved effective. The author nevertheless advises that boys during the flowering season of the wheat be set to collect all the diseased ears in a sack of some kind of cloth to avoid the spread of the spores. It will be advisable to wrap up the ear before picking it in a piece of cloth bathed in, and preferably dripping with, a solution of sulphate of copper. The sack too, after the ears have been emptied out, must each time be soaked for a quarter of an hour in a solution of sulphate of copper. When the infected ears have been removed from the field, the entire plant to which these ears belonged must be pulled up; after this both plants and ears must be buried in a hole, covered with quicklime and then with earth, in some waste part of the property.

Finally, the author points out that selection in the case of wheat as with all other cultivated plants, provides the farmer with varieties valuable not only by their higher yield but likewise by their resistance to disease.

BACTERIAL AND FUNGOID DISEASES OF VARIOUS CROPS.

1468 - **Diseases of Tomatoes.**

FINARDI, E. Parassiti vegetali del pomodoro. — *L'Avvenire Agricolo*, Year XX, No. 7, pp. 290-292. Parma, 1912.

Tomato crops in the Province of Parma have been severely attacked by various diseases. Among these, the most widespread are: bacteriosis (*Bacterium Briosii* Pav.) (1), potato-disease (*Phytophthora infestans* De Bary) (2) and *Septoria Lycopersici* Speg. (3). The author describes the three diseases and suitable methods of control for them.

1469 - **Withering of *Dendrobium nobile*.**

PAVARINO, L. Avvizzimento del *Dendrobium nobile* Lindl. — *Rivista di Patologia Vegetale*, Year VI, Nos. 16-17, pp. 241-242. Pavia, 1912.

In the hot-houses of the Botanical Gardens of Pavia, Italy, several specimens of *Dendrobium nobile* have been attacked by a serious disease characterised by general withering, more pronounced in the young leaves, and by successive disorganisation of the shoots, the supporting tissues of which finally assume a blackish hue. From the diseased tissues the author has isolated a micro-organism (*Bacterium Dendrobii* n. sp.) which he regards as the agent of infection, as he was able to obtain by means of a diluted broth of a pure culture of this bacterium reproduction of the disease with all its original characters.

1470 - **A Disease of the Leaves of *Pelargonium peltatum* caused by *Coniothyrium Trabuti* n. sp.**

RIZA, ALI. Une maladie des feuilles de *Pelargonium peltatum*. — *Bulletin trimestriel de la Société mycologique de France*, Vol. XVIII, Part 2, pp. 148-150, figs. 1-2. Paris, 1912.

The writer has studied a disease found on leaves of *Pelargonium peltatum* grown in a garden at Tangier (Morocco) and sent to the Station of Plant Pathology of Paris; it is characterised by ill-defined patches of a yellowish colour on which, especially on the lower surface of the leaf, are scattered a number of small black bodies. The latter are the pycnidia of a species of *Coniothyrium*, which the writer describes as new to science and to which he gives the name of *C. Trabuti* n. sp. He states that careful prophylactic cupric spraying is an efficacious method of controlling the disease.

1471 - ***Physalospora latitans* attacking *Eucalyptus rostrata*.**

AVERNA-SACCA, R. *Physalospora latitans*, Sacc. — *O Fazendeiro*, Year V, No. 6, pp. 232-235, figs. Sao Paulo, June 1912.

In August 1911 the author first observed this fungus on *Eucalyptus rostrata* in the Forest Garden of Rio Claro. It was doing considerable

(1) See No. 1544, *B.* May 1911.
(2) See No. 1238, *B.* Aug. 1912.
(3) See No. 2986, *B.* Aug.-Sept.-Oct. 1911. (*Ed.*).

damage to the leaves and branches. Subsequently he found it again on *E. rostrata*, at Jundiahy, Varzea and S. Bernardi; the other numerous species of cultivated *Eucalyptus* near at hand were free from infection, although this *Physalospora* had been classified by Saccardo on the basis of material belonging to *E. colossea* gathered at Coimbra.

Usually the disease sets in between the end of July and the beginning of August. The leaves affected wither away on the tree and fall prematurely if the disease attacks the stalk; new branches almost always die.

Heat and moisture appear to promote the growth of the fungus. When the latter invades the young plants it can be controlled by a preventive application, to be carried out in July, of Bordeaux mixture (10-10-100); it is essential however to employ a sprayer which distributes the mixture uniformly and finely over the parts affected. Where adult trees are in question recourse must be had to thorough pruning and the destruction by burning of the infected branches and leaves.

PARASITIC AND OTHER INJURIOUS FLOWERING PLANTS.

1472 - **Couch Grass** (1).

KRAUS, C. Die gemeine Quecke (*Agropyrum repens* P. B.). — *Arbeiten der Deutschen Landwirtschafts-Gesellschaft*, Part 220, pp. VIII + 152, 21 figs. Berlin, 1912.

PARASITIC AND OTHER INJURIOUS FLOWERING PLANTS

The author, after giving a full list of the common German names of this weed, many of which are common to other grasses which are serious pests to the farmer, and after indicating the botanical nomenclature and enumerating the varieties of this plant, points out that it is spread throughout Europe (less in the south than in the north), in Asia (Asiatic Russia, Corea, etc.), in North Africa, North America and South America (Uruguay, Patagonia, Tierra del Fuego); from the plain it extends up to an altitude of 2130 metres; it presents the characters of ruderal plants, and adapts itself to all climates and all soils, where it propagates itself very easily either by portions of its rhizome extending in long runners or by means of the seeds carried by the wind or mingled with those of field crops, to which the rapid spread and extreme persistence of couch grass occasion serious damage, as is well known. With regard to its utilisation as a field and forage plant, opinions are divided. It is however of recognised importance in the preparation and consolidation of farm land. Its rhizome, once made use of in German medicine, is still employed as cattle food, as manure, when it has lost its vitality, and for litter.

(1) See No. 3011, *B.* Aug.-Sept.-Oct. 1911; No 430, Feb. 1912. (*Ed.*).

The author then describes minutely the entire plant from the morphological point of view and studies the lower and underground portions anatomically and chemically.

The seeds as soon as they reach maturity are ready to germinate; the plantlets to which they give birth grow with great rapidity. No less speedy is the development of the new plant when it arises from the pre-existing rhizome instead of the seed. Noteworthy is the great depth (about 16 in.) to which the latter can extend during the course of its existence, and likewise its great extension in point of length (to 33 in.). This the author has been able to verify not only in nature but by suitable experiments, which moreover make it clear that if the plant grows on very wet soil it suffers greatly owing to want of air, and also when grown among other plants suffers owing to want of light. The rhizome pulled out from the soil and exposed to the air continues to grow, but prolonged excessive drought exerts an unfavourable influence on it even if the rhizome is beneath the soil. Very variable are the effects of cold on the rhizome, which sometimes succumbs, and sometimes, on the contrary, is only partly injured. Alkaline substances and primarily ammoniacal substances and those which give off ammonia during decomposition, such as concentrated slag, sewage etc., result in the death of couch.

As a means of control (1) against this weed, the author indicates the tilling of waste lands, the cultivation of hoed crops and of crops which produce a heavy shade, and the utilisation of arable lands invaded by couch as grazing land.

1473 - Parasitic Flowering-Plants in Madagascar.

JUMELLE, H. and PERRIER DE LA BATHIE, H. Quelques Phanérogames parasites de Madagascar. — *Revue générale de Botanique*, Vol. XXIV, No. 284, pp. 321-328, figs. 1-4. Paris, August 15, 1912.

The authors in the first place record the presence of *Thonningia malagasica* at Analamazaotra, as a parasite on the roots of a new species of *Elaeocarpus* (*E. quadrilobus*). Hitherto no information whatever was available in relation to the plants which serve as the host for this *Thonningia*.

Other parasitic phanerogams described as new by the Authors from Madagascar are: *Balaniella Hildebrandtii*, found in the dense forest of Manongarivo, on the roots of *Ficus Baroni*; *Rhopalocnemis malagasica* nov. sp., discovered near Manongarivo on hosts which were not identifiable in consequence of their bad state of preservation; and *Hydnora esculenta* nov. sp., discovered in the basins of the Menanara and the Linta

(1) See in this connection the references on the previous page. (*Ed.*).

on roots of *Acacia* and other Leguminosae; the berry of this *Hydnora*, locally called "voantany" (earth fruit) because on maturity it remains embedded in the sandy soil, tastes like a Reinette apple and is one of the best fruits of Madagascar.

1474 - **A Good Method of Weed Control in Russia.**

ANZIBOR, S. Sposob Borbi s Sornimi Travami. — *Selskii Khosiain* (The Farmer), XXVII Year, No. 32, pp. 1717-1721. St. Petersburg, August 8, 1912.

In Russia weeds on the average occupy 15 per cent. of the entire area under cultivation, and in some localities reach 30 to 50 per cent. The damage they produce may be computed as representing a loss of 20 per cent. of the crop, which would mean for the entire empire, restricting the calculation to cereals, the enormous figure of 16 million francs worth of grain annually lost. This consequently is a loss far exceeding that occasioned by drought, hail, insects and fungus diseases.

From the observations and experiments conducted by the author it appears that deep tilling of the soil may form an excellent means of control. On two adjoining plots of land, after the rye crop in September, ploughing work was carried out to a depth of 5 ½ and 12 in. respectively, the land being then left open and fallow. Only a few days elapsed in the first case before numerous shoots covered the field with green, while in the more deeply ploughed parcel the soil remained clean and black until the end of the winter.

In the spring beet sowing was carried out. The determination of the quantity of weeds was made in the month of April and yielded the following results: in the soil ploughed to a depth of only 5½ in. 58 weeds per square yard, and in the land ploughed to 12 in. 5 only, and almost all of them perennial plants.

The example reported goes to show that the seeds of weeds at a certain depth are unable to germinate for want of air and heat, and even if they do germinate, the shoots do not possess the power to traverse a depth of soil of 12 in. The depth of 12 in. must be regarded as an average value: of course in clayey and tenacious soils 8 to 10 in. may suffice, which in loose and sandy soils would be utterly insufficient.

It is moreover sufficient to carry out this cultivation once every two or three years. It is precisely owing to the necessary deep ploughings that in the beet zone weeds have greatly fallen off and the percentage of impurities in cereals is barely ½ per cent., while elsewhere it reaches 5 per cent.

If moreover the work thus executed should cost twice the amount, the advantages thence derived are not limited to the destruction of the weeds, inasmuch as the greater the thickness of the soil broken up, the less rapid is the evaporation and the greater the degree of moisture of the soil,

and therefore the less the fear of drought; further, this work tones down the great fluctuations in the degree of moisture and temperature of the soil which, in agriculture, are the most important meteorological factors.

INSECT PESTS.

RESISTANT PLANTS

1475 - **Resistance of Mauritius Sugar-Cane to Termites in India.** — See above, No. 1415.

MEANS OF PREVENTION AND CONTROL

1476 - **Methods for the Control of Insect Pests, with Special Reference to the Egyptian Cotton Worm (*Prodenia litura*).**

DUDGEON, G. C. and GOUGH, LEWIS H. in *The Agricultural Journal of Egypt*, Vol. I, Part II, pp. 55-65. Cairo, 1912.

In considering the question of the control of the Egyptian cotton worm (*Prodenia litura*), the writers discuss all the types of control for insects, and mention the reasons for or against their adoption for this particular pest in Egypt. These methods can be divided into six main classes:

1. *Internal Poisons.* — Chiefly insoluble arsenic compounds; applied dry or in suspension in water; act by poisoning leaf-eating insects. Unsuitable for Egypt owing to the danger from misuse or carelessness; also, owing to lack of rain, they remain on the plants a long time, thus extending the danger of poisoning stock.

2. *Contact Insecticides.* — Generally emulsions of paraffin or other mineral oils in soap solution; act by clogging the spiracles. Cotton worms, like most other Lepidopterous larvae, survive the treatment.

3. *Hand-picking of Eggs, Larvae and Adults.* — Normally used where eggs are laid in clusters and methods 1) and 2) cannot be applied, and for large larvae (such as those of sphinx moths), or adults (cockchafers in Europe; in Trinidad for a large moth, *Castnia licus* (1), whose larvae damage sugar-cane: in the latter case butterfly-nets are used). Hand-picking of the eggs is the method enforced by the Egyptian Government for the control of cotton-worm.

4. *Trapping.* — Used for adults or larvae; consists in the use of lights by night, shelters by day, and attractive substances or food-plants. The subject of traps needs careful investigation for each insect, especially as to the proportion of females caught before egg-laying. Some success has been obtained against the Indian boll-worm (*Earias insulana*) (2) in India by planting *Hibiscus* round fields of cotton, but only on small plots; also against the American boll-worm moth (*Chloridea* [*Heliothis*] *obsoleta*) (3) in Egypt by planting early maize between the rows of cotton.

(1) See No. 440, *B.* Feb. 1912. (*Ed.*)
(2) See No. 3048, *B.* Aug.-Sept.-Oct. 1911.
(3) See No. 3047, *B.* Aug.-Sept.-Oct. 1911. (*Ed.*)

5. *Introduction of Natural Enemies.* — Chiefly predaceous beetles or parasitic Hymenoptera; also parasitic fungi for scale-insects. The larvae of a species of *Calosoma* (Carabidae) have been found doing great destruction to cotton worms here and there in Egypt; they were, however, difficult to breed, being largely parasitized by Tachinid flies; one adult reared also devoured the cotton worms.

6. *Alteration of Cultivation Methods.* — Alteration of date of planting a crop, or dropping a crop out of the rotation. Thorough uprooting of old plants of cotton, *Hibiscus*, etc., instead of cutting them down, is being encouraged in Egypt to attempt to starve out the boll-worm (*Earias insulana*) in winter. It is known that the spring generations of the cotton worm feed on berseem, so that the stoppage of the irrigation at the end of April and consequent early drying-off of the berseem crop would check them; but the difficulty of lack of forage at that time of year is considered sufficient to prevent the adoption of this means of combating the pest.

1477 - **Tobacco Extracts, their Comparative Value as Insecticides.** (1)

HOLLISTER, W. O. in *Journal of Economic Entomology*, Vol. 5, No. 3, pp. 263-267. Concord, N. H., June 1912.

The writer made comparative tests of the killing-power of various preparations containing nicotine, as well as of pure nicotine and nicotine sulphate. The bed-bug (*Cimex lectularius*) was the insect used, as being of a resistant nature. All the preparations were used at strengths giving 0.50, 0.75, 1.0 and 2.0 per cent. of nicotine. The results showed little difference between the different mixtures at 2 per cent., all giving practically complete killing. As pure nicotine has considerable advantages in being cleaner to handle and free from other constituents of tobacco which are nauseous or injurious, the writer recommends its use.

1478 - **Ortho Arsenite of Zinc as an Insecticide.**

COOLEY, R. A. in *Journal of Economic Entomology*, Vol. 5, No. 2, pp. 142-146. Concord, N. H., April 1912.

The California Spray-Chemical Company has put on the market an insecticide called ortho arsenite of zinc, which is a very finely divided and bulky powder. From experiments made with this at the Montana Experiment Station during two seasons, it is considered valuable, especially owing to the price being much lower for the arsenic contained than that of arsenate of lead.

Its chief characters are that it is finely divided and spreads well, equalling arsenate of lead in this respect; it is nearly as strong in arsenic as Paris green, but with a water-solubility even lower than that of arsenate

(1) See No. 304, *B.* Jan. 1911; No. 1963, *B.* June 1911. (*Ed.*)

of lead. As with other arsenic compounds it is found that its suspension qualities are much improved by the addition of a small amount of soap to the water.

Tests on the bark of apple trees have shown that it causes less injury than any other of a number of arsenic compounds used. The killing-power, tested on Colorado potato-beetle (*Doryphora* 10-*lineata*), the larvae of the European cabbage butterfly, (*Pieris* [*Pontia*] *rapae*), and the larvae of the diamond-back moth (*Plutella maculipennis*), was found equal to that of arsenate of lead and Paris green ; at 3 lbs. to 100 gallons it did no damage to cabbages.

INSECTS INJURIOUS TO VARIOUS CROPS

1479 - **Maize injured by Wireworm (*Agriotes lineatus*) in Bessarabia** (1).

Koslovskii, G. Nieskolko Slov o Provolocnom Cervie (*Agriotes lineatus*). — *Khosiaistvo* (The Farm), Year VII, No. 30, pp. 1000-1001. Kiev, August 2, 1912.

In the year 1912 serious injury was caused in Bessarabia by *Agriotes lineatus*, the grubs of which destroyed a large quantity of young maize. The damage was above all sustained by the early seeds, owing to the low temperature, which delayed germination and impeded the first stages of growth.

On the experimental field of the Agricultural Station of Kokorosen maize was sown on plots which had been under various crops in the previous year; hence the opportunity arose of studying the effect of the previous crops. The greatest damage occurred where maize had been grown in the previous year, while on the plots following potatoes, sorghum, barley and soy beans, the grubs appeared in an almost insignificant number.

A rational rotation together with an abundant use of mineral fertilisers forms an excellent means of control.

1480 - ***Bruchus obtectus*, a Haricot Pest in the Neighbourhood of Paris.**

Billaudelle, L. La bruche du Haricot aux environs de Paris. — *Revue horticole*, Year 84, No. 15, pp. 359-360. Paris, August 1, 1912.

In the environs of Paris during 1911, to the damage occasioned to haricots by the great summer drought there was added the no less material injury caused by a beetle already known in the South of France, *Bruchus obtectus*, the presence of which became manifest towards the end of October. The insect rapidly drills through the seeds, devouring them almost entirely. To prevent its spread the most effective means consists in placing the seeds suspected of harbouring the parasite, before sowing, in a cask, box or other airtight receptacle, and subjecting them to the action of carbon disulphide vapour (13 oz. per bushel of seed.).

(1) See also No. 1586, *B.* May 1911. (*Ed.*).

1481 - **The Anthonomus of the Raspberry and Strawberry (*Anthonomus rubi*, Herbst).**

The Journal of the Board of Agriculture, Vol. XIX, No. 5, pp. 394-396. London, August 1912.

This beetle is generally known in Europe as a pest of various cultivated Rosaceae, principally raspberry. In England, however, during latter years, very considerable havoc has been observed to be caused to strawberries in consequence of the attack of the adults and grubs of *Anthonomus rubi*. The adult deposits its eggs in the as yet unopened buds and the grubs feed on the latter. The adult further pierces the peduncles, causing the flowers to fall. It is difficult to control this insect. It is recommended that its first appearance should be carefully looked for; when it takes place the insects are caught with nets, or the plants invaded are shaken, so that the insects drop into receptacles placed beneath and containing tar or paraffin.

1482 - **The Gooseberry Gall Midge or Bud Deformer (*Rhopalomyia Grossulariae*, Felt).**

HOUSER, J. S. in *Journal of Economic Entomology*, Vol. 5, No. 2, pp. 180-184. Concord, N. H., April 1912.

The gooseberry gall midge is so far only known on one farm in Ohio, but it seems capable of doing serious damage.

The appearance of the diseased bushes is characteristic, galls consisting of closely-packed buds occurring here and there on the twigs: these are due to the growth of extra buds round the ones infested, which do not develop or produce only dwarfed shoots.

The adult insect appears in early May; it has the appearance of a typical Cecidomyid and is of a reddish-brown colour. The female is sluggish and can hardly fly; it lays its eggs within a few hours of emerging, and apparently soon dies. The writer has found the eggs singly or in clusters in the new growth coming from the old galls. They hatch in a few days. Each larva occupies a cell formed by living bud-scales, surrounded by some dead ones; when full-grown it is of a pinkish colour and is about 2 mm. in length: it lacks the anchor (breast-bone) process. The writer believes that the larval stage extends over only one season. Pupation takes place in the cell in April, the pupa being head-downwards.

The remedy is to cut out and burn the galls in autumn or winter.

1483 - ***Rhizoglyphus echinopus* as an Orchid Pest.**

SIRKS, M. J. *Rhizoglyphus echinopus* als Orchideenfeind. — *Zeitschrift fur Pflanzenkrankheiten*, Vol. XXI, Part 6, pp. 350-356, figs. 1-2, table IV. Stuttgart, August 3, 1912.

In 1911 the collection of orchids in the Botanical Garden at Leyden was severely attacked by a disease of unknown origin which had already manifested itself in September of the previous year. The disease destroyed

almost all the specimens. On the upper face of the leaf of some orchids (for instance *Cypripedium calurum*) it gave rise to the appearance of numerous spots of a pale green colour and sunk in. On the leaf of *C. Crossianum*, *C. barbatum nigrum*, etc., the sunken spots had the appearance of having been nibbled away; they were moreover symmetrically disposed on the upper face, laterally to the mid-rib. The transverse section of the leaves showed that only the epidermis was affected. In the spots the sunken cells exhibited fairly pronounced bends of their lateral walls; here and there however there were apparently unmodified epidermal cells which occasionally contained a small spherical body yellow in colour. Further, the outside wall of the sunken cells and those apparently unaffected was often traversed by one or more small channels. In the cells which were not entirely sunk in and in those of healthy appearance these channels were shut off inside by a kind of plug of cellulose nature; these plugs were wanting in the entirely sunken cells.

In other cases, for instance in *C. insigne*, the base of the leaf had become of an intensely brown hue. The most general alterations however were those affecting the roots, which exhibited an intense brown hue and showed thorough deterioration at their points of junction.

In the diseased roots the Author found in great abundance *Rhizoglyphus echinopus* in various stages of development; a specimen of the same acarid was also encountered on a leaf corresponding to the basal blackened portion. He is therefore of opinion that *R. echinopus* is the cause of the alterations of the roots and base of the leaf. As regards the first form of alteration described, the leaf spots, the Author thinks that the yellow spherical body found in the unsunken cells represents an egg of *R. echinopus*; nevertheless he is not in a position to confirm this hypothesis. As regards the small channels, he thinks that they may have been perforated through the cell wall by the acarid (which lives not only in the soil and roots but also among the young undeveloped leaves), in order that it might feed on the contents of the cell. The cells without cellulose plug are consequently entirely fallen in, while those which are only sunken in part or not at all are always provided with the plug, which has perhaps prevented them from suffering the same fate as the other cells.

1484 – *Nysus senecionis*, a Vine Pest

SEMICHON, LUCIEN and PICARD, F. Le *Nysus senecionis* et ses dégâts sur la vigne. — *Le Progrès Agricole et Viticole*, Year 29, No. 33, pp. 203-206. Montpellier, August 18, 1912.

Nysus senecionis Schill. (Hemiptera) is common in France on crucifers, but under given circumstances, may likewise invade vineyards. Here it pierces with its proboscis the leaves, the leaf stalks and the young branches, causing rapid withering of the lower leaves, which is very

shortly followed by that of the entire upper part of the plant. From the middle of July 1912 onwards the authors observed, in various communes in the departments of Aude, Hérault and Gard, very serious havoc occasioned by the unusually abundant invasion of *Nysus* on vines as yet ungrafted or only recently grafted; the adult plants on the contrary as a rule remained immune from the attack of the insect. Having further observed that the invasion of *Nysus* coincided with the elimination from the vineyards of *Diplotaxis erucoides*, which forms the ordinary food of the insect, the authors held that to this fact must be attributed the exceptional damage sustained this year. Consequently they recommend that no work of cleaning the young plantations should be carried out in July, because the soil harbours *Diplotaxis*, and *Nysus* abounds. On the contrary, the growth of the crucifer in the spring is to be prevented, because it serves to attract *Nysus*, which subsequently attacks the vines. If these preventive measures have not been adopted, it will be needful to destroy the bug direct, without delay, by means of suitable insecticides. Many of these having been tried (arsenate of lead, essence of turpentine, together with Bordeaux mixture, petroleum emulsion and black soap, sulphuric acid, etc.) with results either negative or not entirely satisfactory in every respect, the authors found the following method very effective: the plants which have not yet dried are wetted with cold water and immediately afterwards strewn plentifully with lime; then, in the neighbourhood of these plants, heaps of *Diplotaxis* are placed. The *Nysus*, finding again their usual food, leave the vines and collect on this sort of trap, on which asphyxiating or highly concentrated corrosive liquids, or better still boiling water, can then be poured.

Whatever the remedy adopted, there can be no hope of completely destroying the insects without repeated applications, and as *Nysus* often takes refuge likewise under clods of earth, it will be necessary to control it in this latter position also.

1485 - Citrus Scale Insects in Egypt.

GOUGH, LEWIS H. Scale Insects upon Citrus Trees and Methods to be employed for their Control.— *The Agricultural Journal of Egypt*, Vol. I, Part II, pp. 89-93. Cairo, 1912.

Most of the citrus scales are found wherever citrus trees are grown; several occur in Egypt, and at least two cause very considerable damage.

Aspidiotus aonidum L. (*A. ficus*), known in America as the Florida red scale, is abundant near Cairo and in the Delta; it attacks chiefly the fruit and leaves, causing the latter to fall, frequently with consequent death of the branches; it does not occur much on the actual bark of twigs and branches in Egypt.

Aspidiotus aurantii Maskell, called in America the California red scale,

is the next commonest; it appears to attack the branches more than *A. aonidum.*

The other species recorded are *Chionaspis citri*, a *Lecanium*, probably *L. hesperidum* L. (observed to be extensively parasitized by Chalcid flies), *Icerya purchasi* Maskell (the fluted scale), and *Dactylopius citri* Risso.

The Department of Agriculture of Egypt is considering taking up fumigation with hydrocyanic acid on a large scale for the destruction of scale-insects.

1486 - Parasites of the "Chinotto" (*Citrus sinensis* Risso).

BIGOT, G. Cocciniglia e Fumaggine minacciano la distruzione della coltura del Chinotto. Rimedi diretti e indiretti da tentarsi. — *L'Italia agricola*, Year XLIX, No. 16, pp. 381-384, 4 figs. Piacenza, August 30, 1912.

In the environs of Savona and Albenga, the rapid spread of two scale insects (*Ceroplastes sinensis* and *Dactylopius citri*) now joined by a fungus (*Meliola Penzigi*, "fumagine"), has put a stop to the progressive increase of the highly remunerative cultivation of the "chinotto" and has furthermore reduced to a sorry state, and in many places destroyed outright, the already flowering plants of this citrus. A chinotto plantation at Finalborgo (Albenga), which ten years ago yielded an average of 8 000 lire (£320) per annum, now barely returns 500 (£20).

The really rational system of control against the above pests consists in thinning out the over-dense foliage, retaining only those branches and twigs which form a cup shape, and also in the radical pruning of trees in order to rejuvenate them, because, being too old and having their branches over-long, devoid of good twigs and ravaged by "fumagine", with the whole of the foliage invaded by scales, they give no hope of any produce. After this, the repeated use of insecticides will prove easily effective in arresting the invasion or keeping it within non-injurious limits. As a result of numerous trials, it seems that the most effective and cheapest insecticide, for both the "chinotto" and the other citruses, is the lime-sulphur wash (formula of the Royal Citrus Station of Acireale). (1).

INJURIOUS VERTEBRATES

INJURIOUS VERTEBRATES

1487 - The Economic Importance of the Little Owl in England.

COWARD, T. A. *Mem. and Proc. Manchester Lit. and Phil. Soc.*, Vol. LVI, No. 8, 1912: quoted by WITHERBY, H. F. in *British Birds*, Vol. VI, No. 1, p. 19. London, June 1, 1912.
MEADE-WALDO, E. G. B.; LOYD, L. R. W.; ACLAND, C. M.; ATCHISON, G. T. The Food of the Little Owl. *British Birds*, Vol. VI, No. 2, pp. 64-66. London, July 1, 1912.
HARTERT, ERNST, etc. *A Hand-List of British Birds*, p. 106. London, 1912.
JOURDAIN, F. C. R. in *The British Bird Book*, Vol. II, p. 391. London and Edinburgh, 1911

(1) See No. 753, *B.* April 1912; No. 975, June 1912; No. 1245, Aug. 1912. (*Ed.*).

The little owl (*Athene noctua*) was introduced into England some thirty or forty years ago, most of the birds being turned down in Northamptonshire and Kent; it has now spread over most of the midland, eastern and southern counties. It has been said to be very destructive to game.

From the observations of the above writers it appears that the pellets of indigestible food thrown up by the old birds contain remains of voles, mice, rats, shrews, beetles, insects and sometimes birds and frogs. The nests or hoards of food stored up, besides the above and sometimes lizards, generally contain young birds, such as thrush, mistle-thrush, blackbird, tits, chaffinch, greenfinch, sparrow, buntings and skylark. Mr. Meade-Waldo, in fifteen year's experience, has never found a game-bird in a nest or hoard, but two other observers record cases of young pheasants being found, and one a case of a little owl being seen to carry off chickens. Earthworms are also noted as not infrequently taken, while five stomachs examined in December contained only these and beetles.

It thus appears that the damage to game and poultry is only occasional; considering the food from a general agricultural standpoint, however, it must be noted that shrews, some of the birds (tits, skylark), lizards, frogs, many beetles (particularly large ones which it may be supposed such a species would prefer) and earthworms, are distinctly beneficial; many of the other birds (finches, thrushes) cannot at present be regarded as distinctly harmful, and the "insects" require discrimination; so that rats, mice, voles and sparrows are left as the distinctly injurious class. If, however, the preponderance of the last over other items, noticed by some of the above observers, is found to be general, the little owl may be considered a useful addition to the fauna of England.

1488 - Enquiry into the Invasion of Voles in Aisne (France) from 1909 to 1912 (1).

GUERRAPAIN and DEMOLON. Enquête sur l'invasion des campagnols dans l'Aisne de 1909 à 1912. — *Ministère de l'agriculture, Direction de l'agriculture, Bulletin mensuel de l'Office de Renseignements agricoles*, Year XI, No. 7, pp. 897-902. Paris, July 1912.

From the enquiry conducted by means of a special question sheet distributed to mayors, in relation to the very serious invasion of voles in the north of the department of Aisne, from August 1909 to February 1912, it was found in the first place that this invasion, which had its origin at the time of harvest in that department (communes of Lehaucourt and Morcourt), extended gradually in every direction, but chiefly towards the south-east. Generally, damage was reported for three years as follows:

(1) See also No. 362, *B.* Jan. 1911; No. 1328, *B.* April 1911; Nos. 2016-2017, *B.* June 1911. (*Ed.*).

In the first year the appearance of the voles was noted; in the second year, owing to their rapid multiplication, some serious losses were occasioned, and finally in the third year, after a progressive decrease, the animals spontaneously disappeared.

All crops were injured, lucerne most of all. In many cases clover, sainfoin, and other forage plants, temporary grass-lands, etc., scarcely yielded half their produce. Spring cereals and mangolds were attacked more or less according to the place. In many communes the losses exceeded 100 000 frs. (£4000).

With regard to means of control, the use of virus in Aisne mostly yielded fitful and negative results. The authors hold that this is due to failure to observe the instructions laid down, and also to the quality of the virus supplied to the farmers.

More regular though still incomplete results were obtained by arsenic. It is inadvisable however to poison mangold seeds by arsenite of soda (steeping the seeds in a solution of arsenious acid in the presence of Solvay soda), and also to use mangold slices powdered with arsenic. More satisfactory is the following method:

Moisten some grain or better rolled oats in syrup or molasses, diluted so that the grains just stick to the finger, then roll these grains in a mixture of flour and arsenic in equal parts; for 100 lbs. of grain are required 5 lbs. of molasses or sugar, and 12 lbs. of arsenic with an equal weight of flour. The poisoned grain, which retains its efficacy for many days, and sometimes even weeks, must be used when the weather is dry; it may be introduced directly into holes excavated by the field mice, or else hidden beneath straw, in drainage pipes, etc.

Indisputable is the efficacy of carbon disulphide, which in a few minutes causes the death of the voles by suffocation. To render its use both economical and practical it is desirable to proceed as follows:

On the evening before applying the remedy, the holes are closed up by the roller or harrow, or else with a stick with a knob at one end. A man can in this way go over four aeres a day. Where voles are numerous and more than 4000 holes are found per acre, 400 are found opened fresh on the following day. Then ¼ oz. of disulphide is injected into each hole, which is afterwards closed by treading. This work is repeated on the following day. From 40 to 120 holes will be found, including those overlooked on the day before. If the operation, which needs from 8 to 10 lbs. of disulphide per acre, has been properly carried out, the destruction will be complete.

The authors are at present engaged in constructing suitable appliances for injecting the disulphide direct iuto the galleries. The injectors used in vine-growing are not well adapted for this purpose.

Sulphur dioxide in vapor form gave satisfactory results; in solution it proved negative.

The cost of materials per acre, adopting the first 3 methods, varies according to the intensity of the invasion. The authors indicate them as follows:

For lands where the inroads are very serious:

Virus.

Virus	8*d.*
Rolled oats	9 ½*d.*
Labour	8*d.*
Total	2*s.* 1 ½*d.*

Poisoned Oats.

9 lbs. of rolled oats	9 ½*d.*
7 oz. of molasses	½*d.*
18 oz. of white arsenic	3 ½*d.*
Labour	1*s.*
Total	2*s.* 1 ½*d.*

Carbon disulphide.

Preliminary closing of the holes	8*d.*
Injection of the poison	1*s.* 0*d*
Carbon di sulphide	1*s.* 8*d.*
Total	3*s.* 4*d.*

From the enquiry carried out the authors draw the following conclusions:

1. The destruction of voles must be effected at the beginning of spring or autumn.

2. The foci of infection must be destroyed at their origin by energetic measures.

3. The method of control which seems to lead with most certainty to the total destruction of field voles is as follows:

(*a*) The application of virus of controlled virulence.

(*b*) After 15 days, if the result is not satisfactory, poisoning with arsenic.

(*c*) 15 days later carbon disulphide.

4. The destruction must be methodical, zone by zone, and must in addition to the cultivated lands, include banks, woods, [illegible] covers, and various places of shelter which might harbour the mice, or where they might winter.

5. This operation would be rendered easy, if it were declared obligatory. In the Law of 24th December 1888, provisions are wanting in regard to field voles. At the present time, it seems that farmers can take steps for the defence of their interests through the mayors' offices.

ALFREDO RUGGERI, *gérant responsable*.

INTERNATIONAL INSTITUTE OF AGRICULTURE

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PREFATORY NOTE

In accordance with the resolution voted by the Permanent Committee of the International Institute of Agriculture on February 19, 1912, which instituted the Service of Correspondents, the Bureau of Agricultural Intelligence and of Plant Diseases begins in this Number of the Bulletin the publication of original articles on subjects of present interest. These articles, which are collected in the first part of the Bulletin, are sent by the most competent representatives of the Science and Practice of Agriculture in the various countries adhering to the Institute.

This collaboration will not in any way alter the character of this Bulletin, the second and larger part of which will continue to contain the abstracts made by the Bureau from the agricultural periodicals of the world.

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The Institute, confining its operations within an international sphere, shall:

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(*c*) Indicate the wages paid for farm work.

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(*f*) Submit to the approval of the Governments, if there is occasion for it, measures for the protection of the common interests of farmers and for the improvement of their conditions, after having utilized all the necessary sources of information, such as the wishes expressed by international or other agricultural congresses, or by congresses of sciences applied to agriculture or agricultural societies, academies, learned bodies, etc.

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The information contained in some of the abstracts dealing with Canada has been most kindly placed at the disposal of the Institute by the Government of the Dominion.

The Canadian abstracting is by Mr. T. K. Doherty, chief of the Canadian Bureau of Correspondence with the International Institute of Agriculture.

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NB. The intelligence contained in the present Bulletin has been taken exclusively from the periodicals, bulletins, and other publications which have reached the Library of the International Institute of Agriculture in Rome during the months of September and October 1912.

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The Editor's notes are marked (*Ed.*).

FIRST PART

ORIGINAL ARTICLES

Mechanical Cultivation

By

MAX RINGELMANN

Member of the National Society of Agriculture of France,
Professor of Rural Engineering at the National Agricultural Institute,
Director of the Machine Trial Station in Paris.

Though the first attempts to use inanimate motors in farming work date back as far as 1835, it is only since 1900 that French agriculturists have begun to be seriously interested in the question of motoculture. Mechanical tillage presents the greatest interest also in the French colonies and in several other countries.

Mechanical tillage cannot be extended to all farms, nor to the whole area of a single farm. In the same way as, in an estate, there is room for the bicycle, for the horse, and for the motor-car, each of which economically answers to different requirements, there is room for the various motors: human, animal and inanimate, each performing economically certain works. For a good many farming operations a certain number of teams of horses or oxen will always have to be kept, which at intervals may economically cultivate a certain area. It is then only beyond this minimum that mechanical culture may be advantageously employed, on condition that it be applied to a sufficient acreage to keep the general expenses per unit of surface sufficiently low.

The favour which mechanical cultivation has met with on the part of our farmers and which is shown by the numerous manifestations organised in various parts of the country, is connected with the general economic conditions of the time: Increase in the prices of everything, greater demands of the working classes, decrease of the number of draught oxen due to foot-and-mouth disease etc. Everywhere endeavours are being made to reduce the number of farm hands, while the farmers tend to combine, and to work with fewer, better paid men, and a more costly plant.

The question of the outlay may well be the same: the cost of an outfit for mechanical cultivation may cost about as much as the number of oxen which it replaces, and it allows of a great reduction in the number of hands. But it must be remembered that in a well conducted farm

the oxen after a certain period of service have still a fair value for the slaughter-house; they have worked at a very low price, the necessary ox driver being now-a-days the most expensive item; whilst the value of machinery diminishes coustantly and at the end of ten years does not represent more than 5 to 15 per cent. of the initial capital.

In working with teams the energy that they expend must be returned to them under the form of food. The idea therefore occurs of replacing animal motors by an inanimate motor which will expend perhaps, on account of the intermediary mechanisms (gears, winches, pulleys, wire ropes, etc.) twice as much energy as the teams to perform the same work. The whole question is to ascertain whether the inanimate motor produces the, say, 200 foot-pounds at a lower cost than the 100 foot-pounds produced by the team.

In general, if it may be stated that the adaptation of any inanimate motor to the various kinds of work on the farm is a problem that has already been solved, from the mechanical point of view, its application is connected with the question of *cost price*, besides the other advantages that the various systems may present, and especially that of a more rapid execution of more energetic work with fewer hands.

It is to be observed also that, from a social point of view, the mechanical cultivation of the soil enables man to utilize farm products to a greater extent than formerly. Instead of transforming into mechanical energy a certain quantity of food, the animals can trasform it into meat, milk or wool and, in many cases, the foot-pounds produced by the draught horse or ox may be economically replaced by those produced by a machine burning a certain quantity of fuel or by a hydraulic motor utilizing the fall from a certain height of a volume of water.

At first only *steam cultivation* was practised. The first attempts in this direction were made by English engineers about 1835, when the wages of farm hands began to rise. In 1862 six systems were being experimented and the Royal Agricultural Society of England organised numerous competitions, especially at Chester (1858), at Worcester (1863), at Newcastle (1865), at Leicester (1868) and at Wolverhampton (1871). In France the question was taken in hand in 1850, 1853, 1863, 1865, 1878 1881 and in 1901.

At present the systems most widely diffused in England, in Germany and in Austria are those employing two powerful windlass traction engines, the cost of which is very high. These two engines alternate in hauling the plough; each motor works only when the other one is stopped; the two steam generators alone work during the whole time. On the other hand the outfit is quickly put into position in the field.

The two engines working only one at a time suggested the idea that it would be a saving of outlay to have only one engine working the whole

time, and driving alternately two windlasses. Unfortunately this system requires a transmission pulley mounted on an anchor-truck and takes a certain time to be put into position for working.

Lastly, in order to still further reduce the capital outlay on plant, the double windlass engine has been replaced by the farm portable engine. This system has enjoyed for a short time some popularity, owing to the advantages it seemed to offer: The engine already existed on the farm and the supplementary plant was not very expensive. In practice, however, these outfits have been abandoned in the *usual working* of a farm, and have been kept only for works of improvement (clearing and breaking up of land) for which there is no limitation as to time; the engine, being too weak, did not supply the plough with sufficient power to accomplish the work rapidly; then the time required for the necessary shifting of position increased the price of the work and did not allow of any economy being realized in comparison with the work performed by teams.

For usual work the system with two windlass portable engines is the most practicable; in France there are several sets of such machines either on large estates or belonging to associations of farmers or to contractors: the latter cannot settle in any locality unless they have at least 1250 acres to plough every year. Though the cost of ploughing or cultivating by machine is higher per acre than the same work performed by teams, all farmers who employ the above-mentioned systems are unanimous in appreciating the rapidity with which the work is done even in weather when it would be difficult to work with teams in the fields; they especially appreciate the perfection and energy of the work which is revealed by an increase of the crops, which can only be kept up by an increase of manuring. It is to be noted here that all these advantages are not, as it is often said, special to steam cultivation; they are common to the other systems of mechanical cultivation.

The higher cost of steam ploughing in France, as compared with that of the work performed by the same machines in England, Germany and Austria, is due chiefly to the expense for fuel. To the cost of coal at the pit (about 16s a ton) are to be added: the cost of transport per rail or per canal, the relatively expensive carriage from the station to the farm and from the farm to the fields, and handling at the station and at the farm; lastly, account must be taken of the unavoidable waste on the journey, so that the fuel ends by costing, when delivered in the field, from 20 to 32 shillings a ton. Teams are indispensable to carry into the fields energy, under the form of coals, and water to the engines. It is thus seen that a first economy would be realized by the suppression of these latter transports by means of a fixed motor sending its pouver into the fields under the form of *electric energy* which could drive motors mounted on

the windlasses. The first attempt at this was made in France in 1879 by Messrs. Chrétien and Felix of Sermaize. It was only much later that what is called *electric ploughing* was commenced in Italy and in Germany.

With this system an economical motor may be used, either a superheated steam, or a producer-gas engine; needless to say that a water power motor, whenever its installation is possible, is very suitable for such stations, of which there are examples in Italy and in France.

Such *central energy stations* with steam or water power may be the property of a great estate, of an industrial association or in future of an association of farmers similar to certain sugar factories and distilleries. Lastly the various factories and works already existing in the country, such as sugar factories, distilleries, mills, spinning mills and others, might in many cases utilize the excess of their power by furnishing neighbouring farms with cheap electrical energy.

The improvements which have been made in automobile motors, which are light in consequence of their great angular velocity, do not cease to attract the attention of the engineers interested in the mechanical cultivation of the soil; it is curious that this system of working the soil has not been called *petroleum cultivation* or *benzine cultivation* to distinguish it from steam or electric cultivation, while the term « *motoculture* » which has been adopted does not really mean anything, as every system of culture requires a motor, animate or not.

Not only may the machine driven by an internal combustion motor be light and of small bulk, but the quantities of liquid fuel and of water for the radiator that have to be carted to the fields are insignificant. Many well-built machines can leave the farm in the morning carrying the fuel and water necessary for more than a day's work without requiring further supplies.

After the windlasses driven by internal combustion motors, the next step was represented by motor apparatus, such as the two American mowers shown at the Paris Exhibition in 1900; then in England notwithstanding the favourable economic conditions that steam sets enjoy in that country, *automobile tractors* were built, and introduced into France in 1904. They are, however, interesting only for light work, which is not precisely what is required from mechanical cultivation.

The attempts made during the last sixty years with the object of modifying the shapes and the action of the parts intended to till soil instead of the usual coulters, shares and mouldboards of our ploughs, were continued. Many models have been invented and have been tried everywhere, without however having been adopted in general practice.

More recently, since 1910, one of the great machine builders of France has turned out a *windlass traction-engine* which works practically

and economically and which has been adopted by several farms in France and abroad.

Last in chronological order, is a traction engine which tows a plough, hauling itself along a cable placed on the ground parallel to the furrow and fixed at each end to an anchor truck which is shifetd along the headland.

In all these systems, and they are numerous, including as they do windlasses, traction engines and tugs, the fuel commonly used is benzine, the price of which increases daily; it would be advantageous to replace it by cheaper fuels such as shale-oil, benzol, or lamp oil; there are, besides, naphthalin and producer-gas motors which have much probability of being used in the future, for some such machines are already mounted as portable engines and in 1910 in the streets of Paris a motor van with a generator fed with charcoal could be seen.

Summing up, during the last few years French farmers and especially the vine growers who are obliged to purchase food for their animal motors, demand mechanical motors capable of replacing their teams; these machines have an assured future before them, as may be seen from the great number of people who, during recent competitions, have come even from considerable distances in the hopes of finding at last the machines they required.

The excessive number of these competitions of a necessarily limited duration, organized on sporting lines by Associations or groups of promoters animated by the best intentions, and liberally advertised, frequently throws discredit on mechanical cultivation. These competitions cannot bring together all the systems existing, and if a show exhibits only middling machines or bad ones or those that are not in good condition, the public that does not know the other systems judges from what it sees, generalizes, and spreads the opinion that "mechanical cultivation is not yet up to the mark!"

These competitions will only be really useful a few years hence, when several systems will have been in current use for some time and when their practical employment will have suggested a certain number of improvements in their details.

It has been seen that mechanical cultivation is to be considered as a means of reducing the number of animal motors on a farm and not of doing away with them completely. It can only operate economically on a part of the land of an estate, and considered from this point of view it can only be employed on large farms. Nevertheless it does not appear rash to foresee in the near future an extension of mechanical cultivation of the soil when, with the object of diminishing the cost price of tilling, several neighbouring farms will associate with the object of providing a sufficient acreage for the economical use of the plant.

The Value of Landed Property.

Based on its net Revenue, its Purchase Price, and the Credit that it Commands.

By

FRIEDERICH AEREBOE

Professor at the Royal Higher School of Agriculture.
Chief of the Division of Rural Economy at the "Hauptritterschafts-Direktion" in Berlin.

There is hardly a problem in the sciences of economics and of agriculture which presents so much interest as the one concerning the value of land and of estates. For a long time past the distinction has been made between a so-called "Common value" of landed property and a so-called "Value based on net revenue" (Ertragswert); the first is defined as the value that a property has for any one, - and the second as the value which is arrived at by capitalising the net returns. The latter is the only price that the farmer will pay when he intends making his living out of the property without losing by it. This latter alone also determines the amount of credit which may be allowed the farmer. This principle is the basis of almost all land valuation and of most systems of agricultural credit. It has also been the chief guide in the legislation of many countries, especially in the matter of taxation, and important measures of agricultural policy have been inspired by it. It is therefore important to examine closely into the correctness of these propositions and espedially of the notion of "Value based on net revenue."

Though this expression is daily used it has never been precisely defined. The statement that the net revenue of an estate has to be capitalized in order to get the real value of the same does not really convey any very clear meaning; for the important question immediately arises: of which period of time are the net revenues to be chosen for this capitalisation? Are the actual net revenues of the past to be taken as a basis, and if so for what number of years? Or are those net revenues which may be expected in the future to be taken? And here it must be clearly understood that the effective net returns of an estate may often have very little to do with its value. An estate is not necessarily valueless or without a value based on net revenue if in consequence of insufficient capacity on the part of its owner it has not yielded any net return for years or decades;

nor is another estate especially valuable if owing to the extraordinary ability of its owner it has given exceedingly rich profits. No one would attribute any value to a property only because it has yielded certain net returns in the past, but exclusively because he felt justified in expecting them in the future. The conditions of the past can only serve as a measure for the valuation of the conditions of the future, and not as a sole and immediate measure . Only the future returns that one can hope to get from an estate determine its value. Consequently these returns must also be estimated for a valuation for the future. *The value of an estate is thus in all cases a quantity that can only be appraised,* that can never be calculated or deduced from the returns of the past or in any other way. How far the net revenue of the past may be utilised for the *valuation* of the net revenue of the future is the next question to be examined.

In the first place it must be recognised that no exact calculations of the net returns of estates, even regarding the past, exist or can exist. Among the reasons for this, the most important is the fact that in agriculture it is impossible to separate even approximately the ordinary running expenses from those which serve for the permanent improvment or enlargement of the estate. In this connection the impossibility of fixing the real amounts to be set apart for the amortisation of buildings, drainage works, machinery, etc., etc., is only of quite secondary importance; but who will say how much of the cost of labour of the farm hands and of the teams is to be debited to the normal upkeep of the state of cultivation of the soil, and how much to its improvement? As an example, the case of a farm which had been allowed to be overrun with weeds and which has been freed from them by years of hoed crops may be taken, — or the case of a rough soil which after years of careful tillage is brought into the condition of a garden. In comparison with such improvements, the accounts of which it is impossible to check, the question as to whether the farm possesses more or less buildings sinks into insignificance. Other great improvements of the land also frequently disappear in the calculation of the net revenue, or cannot be separated with any approximate exactness from current expenses. Such, for instance, are the increase in the capital represented by food stuffs due to better manuring carried on for years, the improvement in the live stock, in the roads, in the division into fields, in the position of ditches, and so forth.

The impossibility also of sharply separating the private expenses of the farmer and his family from those of the farm contribute to render the determination of the net revenue extremely unreliable and incomplete.

But even if all this were left unconsidered, if it were possible to calculate exactly the net revenues of a farm for every preceding period, they would still give a very incomplete idea of the possible revenue conditions of the future. In the first place all the economical conditions of the future

might be different from those of the past, but still more decisive is the circumstance that the net revenue of an estate does not depend so much on its intrinsic qualities as upon the knowledge and energy of its manager. According to these purely personal factors, identical estates in identical situations yield infinitely varied returns. Lastly it must be remembered, not only that the returns yielded by an estate at any given moment determine its value, but that the question arises also as to what — taking actual conditions as a basis — it may be made to yield by permanent improvements. If for example the gross returns of an estate may be notoriously increased above the corresponding expenses by a system of drainage, equally competent farmers would all value it higher than another property which, with the same management, has yielded the same returns but presents no such possibility of drainage.

Summarising what has been said above, it is clear that the calculation of the net revenue of landed property based on book-keeping, even considered as a simple aid for the valuation of the revenue conditions of the future, can only be used very conditionally.

The question naturally presents itself, whether there is any other way of ascertaining the future returns of properties so as to be able to found upon them the calculation of their value (Ertragswert). This question has always been answered in the affirmative since the existence of a science of agriculture, and precisely by the branch dealing with agricultural land valuation. This has developed a system of valuation for the determination of the value of land based upon the returns it yields, according to which the expert after a careful inspection of the property draws up a plan of farming of medium intensity. On this plan the average gross returns to be expected and the average coorresponding expenses to be deducted are calculated, the difference giving the net returns, which being capitalised yield the value of the property.

This so-called valuation according to revenue (Ertragswert), is impracticable, unscientific and indefensible. As to its impracticability, the most important arguments are the following: Even admitting a fixed plan of management it is quite impossible to say with any degree of exactness how many bushels of wheat, pulse, hoed crops or hay the soil of a farm will produce. A mistake of only one bushel per acre of wheat in the crop valuation makes, under the assumption of the same cost of cultivation, such a difference in the net returns as to reduce when capitalised the whole valuation *ad absurdum*. It is the same with the returns from the live stock and with the valuation of the various working expenses. If it is already impossible to calculate exactly the net returns of known values with known sums of money, it is evident that the estimate of net returns of not precisely known values, and with the aid of only estimated figures, must lead to purely arbitrary results.

If, however, a valuation of net returns were practicable, the determination of the capital value of this revenue would not yet be complete, for the rate of interest at which the net revenue is to be capitalised remains to be settled. Who will decide this question?

In fixing the rate of interest at a half per cent. more or less, a very considerable difference in the amount of the value follows. In these considerations the most important is not so much in the practical impossibility of carrying out a valuation based on revenue, as in the fact that the whole proceeding cannot be defended on scientific grounds. It rests on the unexpressed understanding that equal net returns of estates correspond to equal capital values. This premise has never been seriously doubted, but that it is false will easily be shown. Agriculture considered from the point of view of private economy is chiefly practised for the attainment of two aims. One of these is to provide the farmer and his family "directly" with a home, fire, several food stuffs, often with clothing and generally with the means of rendering life more enjoyable. The second object is the acquisition of money, which, however does not represent a final object, for the money earned by means of the farm serves also for maintenance and comfort. Ready money is thus also only a means of attaining an end that the property in many respects already serves directly. The money earned by means of a property allows the farmer to develop his physical and spiritual life because it enables him to provide himself with the means of sustenance and of recreation that the property does not offer directly. As to the measure in which this takes place, it does not depend solely upon the amount of the money earned, but especially upon the purchasing power that a certain sum possesses according to the position of the residence of the farmer. With £50 net revenue in a farm situated in an outlying district, the same wants cannot be satisfied, nor in the same measure, as in the neighbourhood of a large town. The expense of the same education for the young people, for instance, will be much higher in the former locality than in the latter; and thus the money available for other objects diminishes to a greater extent. It is the same with the purchase of those objects required by the household of the farmer which the property itself does not produce. The same may be said of the social wants, felt by all, such as of divine services, theatres, concerts, etc., and of the needs for health and life offered by the vicinity of medical men and of chemists, besides a number of advantages which in a distant farm are much more expensive or in a lesser measure attainable than in the neighbourhood of a large town.

In short, the purchasing power of the same net revenue in money varies immensely with the different localities in which farms are situated and consequently the amount of enjoyment which may be procured with the same amount of money. If this is true, how can the same net returns

of properties situated in different localities correspond to equal values ? It is preposterous.

The reverse is the case with all returns in kind, and advantages that a farm offers directly to its owner and his family ; if these are the same in quality and amount they have the same importance for the farmer whatever be the locaility in which he is situated. According to the usual calculation based on net returns, these however would be valued in money according to what they would fetch in case of sale. In this case also the net revenue reveals itself as a most insuffcient measure of the capability of a farm in satisfying the needs of its owner.

The net revenue does not afford an immediate measure even of the amount of cash that farms yield to owners of equal ability, for according to the locality in which they are situated and their economic surroundings the part of the net revenue that the owner has to give the State and the municipality under the form of personal taxes varies considerably. Likewise the rate of interest that the farmer has to pay for the same amount of debt he may incur varies according to the locality of the farm and according to the degree of development that the system of credit has attained in the various parts of the country. Personal taxes and the interest on debts, as is well known, do not affect the net revenue of farms, but they have a vital influence on that part of the net revenue which is available for the farmer's own consumption. *It is therefore completely erroneous to consider the value of farms as varying directly with their net revenue.*

The values of properties obtained by capitalising the so-called net revenues are quantities that have no connection with reality and are of no real value in practice. In so far as a farm is the residence of the farmer and his family, this residence is valued according to the sacrifice it would entail to obtain the same amount of comfort elsewhere. In so far as a farm is a source of profit in money it is not only valued according to the sum of money that can be earned with it, but assumedly by that part of this money which is available for the farmer's consumption and the amount of his and his family's needs he can satisfy with this part, according to the locality in which his farm is situated. This double valuation finds expression only in the prices of farms.

In all political economy, there are — as is being always more recognised — only values which are deduced from prices. The value of a milch-cow depends upon the net price that can be realized for it ; the value of milk upon the net price that it directly fetches, or upon the prices of butter and cheese, and the prices of the labour and of the implements, etc., required for the working up of the milk.

With farms also matters are no different. They also in practice are exclusively valued according to the purchase price paid for them or for the net price that may be had on selling them. It would be out of place

here to enter into the politico-economical discussion of the doctrine of the prices and values of commodities.

That the above view is correct, however, appears immediately from the fact that the valuation of farms follows the rise and fall of their prices and with the disappearance of price every value in the economical sense disappears.

In these considerations, the circumstance is specially important that in the formation of the prices of farms all the factors which directly or indirectly satisfy the needs of man contribute, with the exception of those which can be had everywhere without price. In the price of farms, not only is the money that can be earned with them valued, but also its infinitely changing purchasing power, and everything that the properties can directly yield to the satisfying of needs, as for instance the greater or lesser possibility of taking part in the spiritual life of the people. The farm is therefore valued as residence, as home of the farmer and of his family and also as a source of revenue. *The valuation as source of revenue is not based upon the net revenue that can be obtained, but upon the quality, extent and price of the various amounts of capital capable of producing revenue existing in the farms*, and which under proper management afford a guarantee for such revenue. People ask what amounts of capital belong to a farm and what prices, for the time being, are to be paid for their purchase in the estates market. *The capacity of farms for yielding revenue is thus measured by the kind, extent and price, at that moment, of the capital existing in the farm, and not vice versa.*

The capacity of yielding revenue is not directly a guide in determining the price. No one is inclined to pay for the amounts of capital existing in a farm a higher price than the actual state of the market warrants. The prices of property are fixed, for the most part, independently of the incomes that can be made from them. Thus, for example, experience shows that they follow but slowly a quick rise in the market of agricultural produce, and, as a rule, the prices of properties fall still slower than the prices of produce.

The prices of farms change also quite independently of the oscillations in the market of agricultural produce and of the means of production, and according to the demand and supply of landed properties. The estate valuer can only be guided by the condition of the estate market and by the current prices of properties and their factors. Any one about to buy is in the same position. His task consists only in finding out the cheapest among the properties offered for sale, and he can succeed in this only on condition of possessing the most intimate knowledge possible of the prices of all the single parts of a property. On the other hand, anyone wanting to sell, must, in the valuation of an estate, still more closely follow the prices of properties. On the revenue that may be obtained and on the other

advantages to be drawn from the properties, there are always great differences of opinion between buyer and seller, even if they are not always expressed. The vendor sells because he values the returns and other profits lower then the buyer does.

Likewise when it is a question of determining the amount of credit which may be granted to an estate, its selling price is always the measure, even if not directly or exclusively. The main point in granting credit consists always in ascertaining whether, in the worst case, the loan would be covered or not by the sale of the mortgaged property. The question as to what price one can be sure of getting by the sale of the mortgaged property follows immediately, and the answer is very different according to the length of time for which credit is granted. The longer the period between the loan and its repayment, the greater the depreciation of the mortgaged property may be. Besides, this liability to depreciation or deterioration of landed property (Devastierbarkeit) varies very considerably according as to whether its value at the time depends to a greater or less extent upon the land itself or upon the more mobile inventory capital engaged in it. Only that part of the value which may be considered as indestructible during the time which elapses between the loan and its repayment can represent security for long credit. But this safe portion of the value of land estates, even with equal prices, varies to a great extent with the natural and economical conditions of the properties and with their state at the time.

On the other hand it is an error to seek the security for long agricultural credit in the amount of revenue that a property yields, because this depends chiefly upon the ability of the debtor, and even if it be normally high it does not even give security as to the regular payment of the interest upon the debt, since any debtor may get into difficulties without the creditor being able to exert any influence in the matter. Still less do the net returns of landed property allow direct security for a loan. This security is only offered by that part of the value of a property which is indestructible during the time over which the credit extends.

From the foregoing, it is evident, that a change in the usual way of considering these matters is imminent and that a radical revision of the whole subject and especially of the doctrine of the values of landed property, becomes necessary (1).

(1) The Author of this paper has endeavoured to pave the way as completely as possible for such a revision in his recently published work "Die Taxation von Landgütern und Landstücken" (Berlin, 1912). (*Ed.*).

The Basis of an International Agreement for the Control of Plant Diseases

by

GIUSEPPE CUBONI

Professor at the Royal University of Rome
Director of the Royal Station of Plant Pathology, Rome.

Now-a-days what is known as *scientific internationalism* has extended to all branches of science and of human activity; a recent publication by Eijkman (The Hague 1911) enumerates 614 scientific and literary institutions having international character and aims.

Internationalism is thus predominant in every field, under many forms and in almost all questions. In this state of things it is not without surprise that we must recognize that in so serious a question and one of such general interest for all nations, as the protection of crops against diseases, international agreements have remained almost nil, notwithstanding the wishes repeatedly expressed and formulated by the experts and agriculturists of the whole world.

It is interesting to examine the causes which hitherto have prevented such agreements.

The agreements which up to now have been proposed and discussed are of two kinds, one practical and the other scientific. The former dealing with legislative measures on the compulsory destruction of infected plants or the use of remedies, with prohibitions of the trade of certain goods, with systems of disinfection and the like, the latter proposing to study more thoroughly the causes of diseases and their possible remedies.

The first kind is evidently of a very delicate nature, because every State tends justly to guard its own autonomy and hesitates to enter into engagements which might injure its legitimate interests or deprive it of its liberty of action in the protection of its agricultural interests, in the manner and to the extent that it deems fit. These are no doubt the reasons which have led the various States to be so cautions in engaging themselves in international agreements concerning the diseases of plants. Until now the only instance of an agreement of this kind is the International Convention against Phylloxera established in 1878 and somewhat modified in

1881. This Convention to which Germany, France, Austria, Hungary, Italy and Switzerland have adhered, concerns, as is known, only one disease, the phylloxera of the vine; a disease unquestionably of very great, nay immense importance, but no one will deny that since 1878 both science and practice have become acquainted with other diseases of crops no less important than phylloxera. And yet no international measure has hitherto been adopted with the object of attempling to arrest their development or to prevent their spread to countries that are still immune.

Regarding international agreements of a purely scientific character with a view of acquiring a more intimate knowledge of the causes of plant diseases and their remedies it would seem that there ought to be no difficulty, inasmuch as every State has the greatest interest in the continuous progress of this knowledge. Practical farmers and scientists, students of plant pathology, have always been unanimous in recognizing the opportunity of international cooperation in the study of plant diseases and in demanding it. Yet, notwithstanding these wishes and the action of eminent scientists such as Eriksson of Stockholm and Sorauer of Berlin, the question after almost a quarter of a century since it was first posed and discussed has not advanced one step towards its practical solution. The proposal of Prof. Eriksson to institute one or more international phytopathological stations as centres for the study of the principal diseases of crops has not yet found either Governements or private patrons disposed to grant the necessary funds for such Institutions.

Even the more modest and practical suggestion of Prof. Sorauer who proposed that an international Committeee should draw up a uniform plan of researches and studies to be carried out by the stations of plant pathology in the various countries, has never been put into practice, because this Committeee, owing to want of funds, has never been able to meet or begin its labours.

In this state of things are we then to conclude that nothing can be done, from the international point of view, for the control of plant diseases?

I do not hesitate to auswer: no; I believe that a practical result would speedily and easily be attained as soon as a basis for the opportune international agreement could be firmly established.

Such a basis, in my opinion, ought to be the International Antiphylloxera Convention of Berne, partially altered and corrected so as to render it applicable not only to the protection of the vine against phylloxera, but also to the protection of all plants against parasitie diseases.

At first sight many will think the project very difficult and complicated, but such is not the case really. If the reader will follow me with

attention. I feel sure that my thesis like the famous egg of Columbus will seem very simple and sound.

Article 3. of the above Convention says: "No plant, shrub or vegetable . . . coming from gardens, nurseries, or green houses shall be introduced into a State except through the Custom Houses to be designated; they must also be accompanied by a declaration of the sender and a certificate delivered by the competent authorities of the country of origin, stating: *a*) that they come from an area (plantation or enclosure) separated from any vine by a space of at least 20 metres, or by another obstacle to the spreading of roots, which shall be deemed sufficient by the competent authorities; *b*) That this area does not contain any vines; *c*) that no vines have been stored upon said area; *d*) that if there have been vine stocks bearing phylloxera they have been radically extirpated, that operations for the destruction of the insect have been repeated, and that during the last three years researches have been made to ensure the complete destruction of the insect and of roots".

"In the trade between the contracting States the certificate of the competent authorities of the country of origin, mentioned in paragraph 1, will not be necessary in the case of plants sent by one of the establishments inscribed in the list published in conformity to Art. 9, No. 6 of the Convention."

The above-mentioned Art. 9, No. 6 provides that: "The contracting States, in order to facilitate their common action, engage to communicate to each other regularly . . . the lists which are compiled and posted up to date, of all establishments, schools, horticultural or botanical gardens which are submitted to regular visits at the proper season and which are officially declared to be in order with the provisions of the present Convention."

The thesis that I maintain is that the International Anti-phylloxera Convention of Berne might very easily be converted into an International Convention against plant diseases if the certificate of the competent authorities which must necessarily accompany the plants, should declare that the plants to be exported not only satisfy the conditions required by the Convention, but also *that they are free from any contagious or parasitic disease caused by fungi or insects.*

This simple innovation, with a few almost insignificant alterations, would be suficient, I think, to convert the Antiphylloxera Convention of Berne into an international agreement agaist plant diseases in general, which without difficulty might be accepted also by all the other States which have not yet adhered to the Berne Convention because they had no great interests in vines to protect.

The *competent authorities* mentioned by the existing Convention should not have any serious difficulty in recognizing if the plants are

suffering from disease or not. These authorities, in Italy, Germany, France, Austria-Hungary and Switzerland, in one word, in all the countries adhering to the Convention, are composed, if not of specialists in plant pathology, at least of professors of Agriculture or their assistants and of delegates who as they know the phylloxera of the vine may also recognize other parasitic diseases of other plants. Even admitting that their instruction might be insufficient, it would not be difficult for every State to complete their instruction by some rapid courses lasting a few months or even weeks, in order to enable them to know the chief diseases.

It is not intended to turn out professors of pathology: as a knowledge of the alphabet is sufficient for some requirements in life, but is not enough to convert an illiterate person into a literary man, so an acquaintance of the a, b, c, of pathology is not enough to make a pathologist, but is sufficient for an inspector entrusted with the duty of judging whether a plant is free from disease or not.

In doubtful cases the inspectors might always appeal to the Stations of plant pathology or of agricultural entomology to solve the difficulty.

New diseases of plants when they are not spread by the wind or by insects are always spread by man by means of international trade.

If the various countries were to engage themselves to admit in such trade only plants provided by competent authorities with certificates declaring them to be free from diseases, or as coning from establishments, gardens or nurseries which are regularly visited at the proper seasons and recognized to be free from diseases, a great progress in the agriculture of the whole world would be realized.

Of course no illusion must be entertained that these certificates would completely prevent the introduction and spread of new diseases.. Unfortunately, independently of the ignorance and bad faith of man, the ways and the means by which the diseases of plants multiply and spread are such and so numerous that it will always be very difficult and almost impossible to guard against them absolutely. Nevertheless the reform which I propose would have at least the indirect advantage of obliging the various States to have a sufficient number of *competent authorities* for the delivery of the certificates of immunity, and consequently the hygiene of plants would necsssarily be much more observed, studied and cared for than it is at present; this would have at least the effect of combatting ignorance, which is always the must dangerous factor in the spread of diseases.

Any how, every one, even the greatest sceptic will admit that my proposal would have the effect of avoiding the great inconvenience which at present is entailed by the actual anti-phylloxera Convention, namely that it often happens that when the *competent authorities* visit plants, nurseries, establishments, gardens, greenhouses, etc., they find that

they are all right as regards the clauses respecting phylloxera, but that the plants that are to be put into commercial circulation are infected by other diseases not less dangerous than phylloxera. In this case, under existing provisions, the inspector has no power to refuse a certificate authorizing free international transit! I am not dealing here with an abstract hypothetical case but with real facts which happen much oftener than is generally thought. Thus for instance a few months ago I was called upon to deliver a certificate for some citrus fruit plants to be sent to Germany. I found that the plants in question were indeed grown in a district perfectly free from phylloxera but they were infected by a most dangerous scale insect, *Icerya purchasi*. I succeded in persuading the owner to abstain from sending the plants away. But who can say how often it is possible to prevent exportation notwithstanding the judgment of the competent authority ?. It is in this way that infected plants which spread new diseases are *legally* admitted into international trade. Probably it is in this manner that some new diseases, such as poplar "canker" *Icerya purchasi* in acacias and many fruit trees, *Ceroplastes sinensis* of citrus fruits, and many others have spread in Europe. Is not this a serious *legal error* that ought to be prevented ? If my proposal had no other effect than that of avoiding the above error, there would be already sufficient reason for its being approved.

My project does not encroach on the autonomy of any single State and does not deprive it of the liberty to control plant diseases in the way that it deems fittest. The certificates of immunity which would accompany plants sent abroad would not prevent any State from submitting them to a new examination in the Custom Houses and from rejecting them if it proved that the certificate of immunity had been unduly delivered.

In such cases the Governments should exchange the results of their own controls, with the object of exerting surveillance on the capacity of the officials authorized to deliver certificates.

The proposal which I support is not at all new, for the obligatory certificate of immunity for plants intended for trade or the obligatory visit by a technical inspector of premises from which plants are exported has already been adopted by several States such as France, Canada and Holland.

Nor would this reform entail new and excessive expenses on the States adopting it, as the officials entrusted with the delivery of certificates should be paid by the owners of nurseries, and horticultural establishments or by the exporters of plants as is practised at present for phylloxera certificates.

In the anti-phylloxera Convention there are other provisions which if properly extended and applied to all the most dangerous diseases of

plants, would render international cooperation for the control of plant diseases really efficient. I allude to the provisions contained in Art. 9 according to which the various States undertake to inform each other regularly of the laws and orders enacted on the subject, of the measures taken for the application of such laws and orders, of the working of the services organized in the interior of each country, as well as of the progress of the pest, of every discovery of new infections of phylloxera in districts till then believed to be immune, with information as to the extent and causes of the invasion. Besides the above the States must communicate to each other a map, drewn to scale and brought up to date every year, showing the infected areas and those which have become suspect owing to the vicinity of centres of infection and lastly they must exchange the results of scientific researches and of the experiments and of the practical work conducted for the control of phylloxera. As can be seen from the above, it is a complete programme which, if it could be extended to all new diseases of plants ought to satisfy the wishes of all those who are most exacting in demanding international cooperation against plant diseases. Such an extension is now possible and relatively easy because during these last years all the principal States of the world have organized a Service of Plant Pathology and are in a position to undertake without great difficulty or innovations the duties of a Convention, modified and reformed on the lines that I propose.

All these informations might be communicated by each State to the International Institute of Agriculture in Rome, which would thus perform a highly important function of efficient utility in the control of plant diseases and really worthy of the magnanimous founder of the Institute and of the States which have adhered to it.

My proposal will not satisfy those who, like Eriksson and Sorauer, have for so many years demanded an international scientific cooperation for the study of plant diseases.

I answer with the well known proverb : *quod differtur non aufertur.* The question still remains open, and my worthy colleagues will agree with me that an international convention on the lines of my proposal, would not in any way thwart their ideas ; on the contrary it would, by increasing the surveillance and the interest in the control of plant diseases, render it easier to induce Governements or some private magnates to grant the funds required for the institution of international phytopathological Stations or of an international Committee for the study of plant diseases.

SECOND PART

ABSTRACTS

AGRICULTURAL INTELLIGENCE

GENERAL INFORMATION

LEGISLATIVE AND ADMINISTRATIVE MEASURES.

1489 - The New Fencing Act in the Union of South Africa.

The Agricultural Journal of the Union of South Africa, Vol. IV, No. 2, pp 282-291. Pretoria, August 1912.

On the 22nd. June, 1912, assent was given to the new Union Fencing Act (No. 17, 1912). The purpose of this Act is " to consolidate and amend the laws in force in the several Provinces of the Union relating to the fencing of farms and other holdings," and its main provisions are as under :

Dividing Fences, Advances for Erection there of and Contributions towards Cost of Erection. — Whenever an owner of a holding desires to erect a dividing fence upon that holding, or is required by another owner of a holding to contribute to the costs of erecting or improving a dividing fence between two holdings, such owner shall be entitled to obtain from the Land and Agricultural Bank of South Africa an advance to defray such cost or contribution provided such cost or contribution exceeds £10. Such advances to be repaid within a maximum period of ten years.

If any owner has lawfully erected a dividing fence on the boundary lines of his holding in an area in which contributions towards the cost thereof are not obligatory and the owner of an adjoining holding adopts means whereby such a fence is rendered of beneficial use to himself, either owner may in default of agreement demand that an assessment be made of the value to each owner of the fence, regard being had to the extent to which and the time at which the beneficial use is being or has been made. Such value shall be determined as a dispute in accordance with the provisions of this Act, and thereupon it shall be obligatory upon the owner who has made beneficial use of the fence to contribute toward the cost of such fence in accordance with such assessment.

Contributions towards the cost of a dividing fence shall be obligatory in any area in which such contributions are declared obligatory by the Governor General, by proclamation in the *Gazette*, and such contributions shall be made from a date fixed by the same proclamation. In default

of agreement between two owners as to the type or price of the dividing fence, either owner may claim that the matter shall be determined as a dispute in accordance with the provisions of the Act.

Compulsory Fencing to prevent the spread of Stock Diseases. — The Minister of Agriculture may call upon the owner of any holding to erect a fence along the whole or any part of the boundaries of the holding if it be within an area declared to be infected or suspected of being infected with disease. If the owner fail within the specified time to erect such a fence the Minister may cause the same to be erected by the department.

The costs of any dividing fence erected by the department under this chapter shall be defrayed out of moneys specifically appropriated by Parliament for the purpose:

Provided that such cost together with interest at 4 per cent. per annum shall be repaid by the owners of the two holdings divided by the fence by equal yearly instalments, commencing two years after the fence is completed and so calculated that the cost and interest will be wholly repaid within ten years from the date on which the first instalment became due.

Provided further that any amount not exceeding two pounds shall become payable immediately after the completion of the fence.

In any case where any Crown land has been fenced under the provisions of this chapter, and has before the erection of the fencing, been leased, the lessee shall, in addition to the rent payable under his lease, pay to the Government interest at the rate of 4 per cent. per annum upon one-half of the total cost of the fence from the date of completion of such fence, provided that the lessee may, if he so desire, cancel his lease.

If a lease or licence contain a right of conditional purchase of the land, then upon that right being exercised, the conditional purchaser shall pay to the Government the instalments due.

Whenever the Minister has incurred any costs in respect of fencing of a native location or native reserve, the adult male inhabitants thereof shall be jointly liable for repayment of one-half such costs and for payment of interest thereon at the rate of 4 per cent. per annum.

In the case of costs in respect of fencing of any town or commonage lands which are vested in or controlled by any local authority, one-half of the cost shall be payable by such local authority.

Any person liable under this chapter for any part of the costs of the erection of a fence may contribute approved material or labour or transport toward such costs and any such contribution shall be set off against the amounts due by him.

No person shall, whether or not the costs of the fence have been repaid, remove any fence erected under this chapter unless he has previously obtained the written permission of the department.

The owners of holdings on which such fences have been erected are bound to keep them in repair. On their failing to do so, the department may execute the repairs and the cost shall be recovered from the owners.

General and Miscellaneous. — An owner shall have the right to fence his holding notwithstanding that such holding is subject to a servitude of grazing or of watering live stock thereon provided that reasonable means of ingress and egress be allowed to the live stock of the servitude holder.

The holder of a servitude of grazing shall be liable to pay to the owner of the holding a fair share of the costs of the fence proportional to his interest in the grazing rights over the holding.

If any fence crosses a recognized public road the owner concerned shall allow an opening of not less than fifteen feet across such road and shall erect and maintain a gate of iron or wood.

Whenever a line of railway traverses a holding the owner of the line shall, except in such areas as the Governor General may by proclamation in the *Gazette* exempt, erect and maintain a sufficient fence on both sides of the line, with level crossings at every place where a recognized public road traverses the line and at any other place that may be reasonably necessary to enable stock to traverse the line from one part of the holding to another.

DEVELOPMENT OF AGRICULTURE IN DIFFERENT COUNTRIES.

1490 - **Agriculture in the Republic of Salvador.**

El desenvolvimeniento industrial y comercial de San Salvador, Reseña general del Pais. El cultivo del café. (Informe del Consulado general de la República Argentina). — *República Argentina. Boletin del Ministerio de Relaciones Exteriores y Culto*, Tomo XXXIV, No. II, pp. 241-266. Buenos Aires, 1912.

Salvador is the smallest but at the same time the most prosperous of the Central American Republics, and its population is perhaps denser than that of any other American State. (130 to the square mile). It is an eminently agricultural country with large possibilities of irrigation and in which fertile volcanic soils suitable for all tropical crops abound. Its chief produce is coffee, which represents 75 per cent. of the total agricultural produce; then follow sugar, rubber, indigo, balsam (which is called Peruvian though it is produced only in Salvador), maize, rice and all kinds of fruit, among which the chief are bananas, pine-apples, oranges, and tangerines.

Coffee was introduced into Salvador by seeds imported from Costa Rica about fifty years ago. Both the climate, which is rainy from May to November and dry from December to April, and the depth of the soil, which allows the roots to develop freely are favourable to coffee.

The best coffee raised in Salvador is that grown on the volcanic slopes, especially in the departments of St. Anna, Santa Tecla, Ahuachapan, and Usulutan. The success attendant upon this crop is due principally to the care bestowed on the plants and on manuring, and to the new plantations

that are constantly being made, uprooting the useless trees or cutting them close to the ground.

The amount produced in 1912 was estimated at 1 180 000 to 1 280 000 cwt., about the same as that of the preceding year ; but it had the advantage of commanding better prices, having been paid as much as £3 12*s.*6*d.* per cent., a price which leaves the coffee planter a net profit of 70 per cent. over the expenses of cultivation. During the decade 1901-1910, 34 per cwt. of the exportation was directed to France, 19 per cent. to the United States, 19 per cent to Germany, 13 per cent. to Italy, 8 per cent. to Great Britain, the rest to Austria, Spain, etc.

The production of sugar is not only sufficient for home consumption, but supplies also an ever-increasing export trade. The yearly output is estimated at about 204 500 cwt. of centrifugated sugar, 204 500 cwt., of loaf sugar and about 94 000 cwt. of « dulce » and « panela », or molasses sugar. About 100 000 cwt. of sugar are exported to Panama, Great Britain, Mexico, the United States and Honduras. Centrifugated sugar bears the names of « marquetas » when it is in loaves of about 7 lbs. each, of " blanca en polvo de primera " if in large crystals, and of " blanca en polvo de segunda " if in small crystals, while molasses sugar is called " amarella en polvo ". The large crystal sugar polarizes at 91°, the small crystal at 93° and the molasses sugar at 88.° Sugar is packed in bags of 100 libras (100.47 lbs.).

The cultivation of indigo and the extraction of its colouring matter are constantly decreasing, and giving way before the more profitable coffee growing. In the last ten years the total value of the indigo exported amounted to £1 153 307 while for the year 1909 it fell to £54 623. The indigo grown is exported chiefly to the United States, Germany, Great Britain, Ecuador, Peru and Chile.

" Balsamo negro " or " Balsamo sonsonate ", improperly called Peruvian balsam, is produced by *Myrospermum Salvadoriense*, a fine tree belonging to the Leguminosae and growing along the Balsam Coast, that is that stretch of the Pacific Coast between the ports of Acajutla and Libertad in Salvador. It lives about 100 years and begins to produce when about 25 years old. The balsam is extracted by means of incisions in the bark made at the termination of the rainy season, or also during the whole year. A tree yields from two to three pounds per year. The total production of the Republic amounts to about 230 000 lbs. The balsam produced in Salvador is distinguished from other balsams bearing the same name but produced in other parts of South America, and often adulterated with Tolu balsam, by its higher content in benzoic acid which gives it its greater therapeutical value.

Rice, maize, and beans, which form the bulk of the people's food, are produced in sufficient quantities to supply home consumption and also

an export trade with the other Central American Republics. In the last ten years, maize, rice and beans were exported to the values of £1980, £19290 and £1163 respectively.

The production of cacao, rubber, tobacco and ropes is also diminishing. The exportation of these staples amounted during the last year to £175, £440, £30929 and £2029 respectively.

The cultivation of cotton has been practised for some time in Salvador but, though successfully, it has been constantly diminishing since 1865. Now it is contemplated to extend it again in the districts of Santa Anna and Ahuachapan; also with the object of protecting the conutry from the dangers of monoculture to which it is always more exposed by the ever increasing cultivation of coffee. The live stock is estimated at 350 000 head of cattle, 90 000 sheep, 220 000 pigs, 29 000 goats and 120 000 horses, mules and asses. The consumption of meat is limited, being an article of luxury for the people. The numbers of animals slaughtered every year are the following: 26 764 oxen, 27 792 cows, 22 896 calves, 896 sheep and 117 640 pigs, representing a total value of about £225 700, which, estimating the population of the Republic at 1 600 000, comes to about 2*s*. 10*d*. per head. Milk and butter are good and they are produced in sufficient quantity for home consumption. There is besides a small exportation of butter to the neighbouring Republics, while cheese and a certain number of cattle are imported from Honduras. The best acclimatised breed of milch-cows is the Holstein. Almost all the transport in the country is performed by draught oxen or by pack mules, as there are only 120 miles of railways.

The forests are being felled without any attempt being made to replant. They supply the only fuel in the country. The chief kinds of trees are mahogany, cedar and walunt. Quebracho is found in small groves.

Deforestation would be still more complete than it is at present if it were not for the cultivation of coffee which requires shade, and which is either grown in the forests that are thinned for the purpose or requires the planting of shade trees. for which mostly Leguminosae are chosen.

Among the local industries connected with agriculture the following may be mentioned: the manufacture of cigars and cigarettes, of straw hats and fibre products of which there is some exportation, of woven goods, silks, foot-wear, furniture, soap, candles (158 400 lbs. per year, manufactured from stearin imported from Belgium and Holland).

Among the importations of the first half year of 1911 there are 453 tons of chemical manures.

EDUCATION AND EXPERIMENTATION IN AGRICULTURE AND FORESTRY

1491 – The Establishment by the Prussians Chambers of Agriculture of Examinations for Farm Pupils on a Uniform Basis.

Die Einrichtung landwirtschaftlicher Lehrlingsprüfungen und ihre einheitliche Gestaltung bei den Landwirtschaftskammern. — *Verhandlungen des Königl. Landes-Oekonomie-Kollegiums* of Feb. 8-10: 2nd Day of 12th Session, pp. 205-206. Berlin, 1912.

A thorough training on a well-ordered farm is of the greatest importance for anyone intending to go in for agriculture. Knowing this, the German Agricultural Society (Deutsche Landwirtschafts-Gesellschaft) has, for many years, made it its business to find out so called instruction farms (Lehrwirtschaften); that is to say, well-managed practical farms, where the owner is able and willing to thoroughly instruct young agriculturists in farming. The German Agricultural Society has worked out a special scheme for this purpose and has devised a final examination for young agriculturists trained on such farms. This example has been followed by the Prussian Chamber of Agriculture and in the February Session of 1912, the Prussian "Landes-Oekonomie-Kollegium" discussed the question of the examination of these students in all its bearings in order to arrive at a uniform scheme of regulations.

The establishment of Instruction Farms was declared to be decreed by the Agricultural Chamber and the following regulations respecting the above were recommended to the Chamber.

A. The examinations are in the first place for such students as have been trained in one of the Instruction Farms recognized by the Chamber of Agriculture. In the period of transition, however, students trained elsewhere are admitted to the student examination.

B. Students, before taking the examination, are required (except in special circumstances) to have worked on the same farm for two years. A certificate that the candidate is a one-year volunteer (einjährig-freiwilligen Dienst) or a school-certificate of equal value is desired.

C. The student pays an examination fee of 20 to 30 marks. Students of small means (on passing the examination creditably) have this fee returned.

D. The examination subjects are chosen according to the following curriculum:

I. The examination is exclusively confined to the principles and elements of practical agriculture, purely theoretical questions being as far as possible excluded.

II. Thus the examination subjects include the following:

1. *A general description of Agriculture:* 1 to 3 marks.

a) Outdoor work (size of farm, type of soil, position of instruction farm, composition of the latter; arable land, wood, grassland, etc.; estimate of area).

b) Indoor work (granaries, barns, hay-lofts, machine sheds, cellar, root stores, manure heaps, etc.).

2. *Behaviour towards labourers;* 1 to 4 marks.

Much stress is laid on this point and tests are given on the following subjects :

a) The capacity for setting labourers to suitable work, imparting correct instruction and superintending them ; also the capability of carrying out all agricultural operations correctly and without assistance.

b) Manner and tone to be adopted in professional intercourse with the labourers.

c) The capacity of the student for correctly judging work and estimating the right number of labourers and the necessary superintendence (in thrashing, steam-thrashing, carrying hay and corn, harvesting, building ricks, carting dung etc.).

3. *The use of Implements and Machinery.*

Knowledge of their use, performance, the way they are put together and their working. 1 to 3 marks.

4. *Work in the Farmyard* (Barn work, giving out rations, food, manures, judging quantities, care of farmyard manure, general maintenance of cleanliness and order in the farmyard and other farm premises. 1 to 2 marks.

5. *Work in the Stables :* 1 to 3 marks.

a) Horses : grooming, harnessing, feeding.

b) Cattle (cows, draught oxen, bulls, young cattle) : cleaning, harnessing, milking, day's work and rations, estimating weight.

c) Pigs.

d) Sheep (wool, shearing, dipping, feeding).

e) General details on stable and cowhouse management.

6. *Knowledge of the Exterior of the Animals* (breeds).

Diseases and their treatment. First aid before the arrival of the veterinary ; precautions against disease. 1 to 3 marks.

7. *Field Operations :* 1 to 5 marks.

a) Working the land.

b) Seeds (cereals, pulse, oil crops, roots).

c) Manuring (farm manure, the most important points respecting atificial fertilisers)

d) Preparation of the seed-bed, etc.

e) Care of crops, the damage done to them by weather, plants and insects.

f) Harvest.

8. *Written work* : 1 to 2 marks.

Inspection of books kept by the student. Diary, farm books, tables (of wages, milk, allowances in kind, food-stuffs, manures, etc.). Calculations. Insurance against sickness, and old age liability for compensation, fire, accident and hail.

9. *Knowledge of the Management and Nature of the Instructin Farm:* 1 to 4 marks.

Rotation of crops and manuring. System of farming, sequence of work, eventual destination of the produce. Cattle-farming (breeding, fattening, milking); large or small number of cattle; the management of pastures, principal crops.

10. *Behaviour and Character of the Student*: 1 to 3 marks

(The preparatory education etc., is taken into account). The decision rests with the president of the examination board.

E. The examinations are, if possible, held on the farm of the instructor. They are held as required and at times when field work is possible.

F. The examination board consists of:

a) A president appointed by the Chamber (who has, as far as is practicable, to conduct all the examinations), and his substitute.

b) A second member, if possible a farm manager, preferably a member of an association of Farm Managers (Güterbeamten Vereinigung) of the district under the jurisdiction of the Chamber (Kammerbezirk).

c) The registrar of the board.

The president of the Chamber has the right to increase the board by the addition of one more member.

The instructor is required (if the board so desire) to be present during the examination.

G. The final decision is left to the discretion of the board.

Special instructions are not given to the board as regards the tests to be put to the student.

H. From 1 to 5 marks *may* be given for each subject, so that the maximum of marks is 32. Candidates must have 20 marks to pass. In cases of unusual excellence, the board adds a statement to this effect to the certificate.

I. Scale of marks.

Very good, 29 to 32; good, 25 to 28; fair 20 to 24;

1		1 to 3 marks
2		1 „ 4 „
3		1 „ 3 „
4		1 „ 2 „
5		1 „ 3 „
6		1 „ 3 „
7		1 „ 5 „
8		1 „ 2 „
9		1 „ 4 „
10		1 „ 3 „
		10 to 32 marks

1492 - **International Competition of Tractors and Steam Ploughs at Chassart, Belgium, in September 1913** (1),

Concours international de Tracteurs et de Laboureuses à outils commandés, à Chassart, Belgique, en Septembre 1913.

Communication from the Colonial Ministry of the Kingdom of Belgium.

The Colonial Ministry sends information that this competition, which was annonced for October 1912, has been put off to September 1913.

There will be no modification of the regulations previously drawn up. Application for entry are received from the present date by the 5th General Direction of the Belgium Ministry of the Colonies, 7 Rue Thérésienne, Brussels, all information respecting the said competition can be obtained.

1493 - **International Horticultural Congress at Ghent, Belgium, 1913.**

Congrès international d'Horticulture à Gand en 1913. — *Revue de l'Horticulture Belge et Etrangère*, No. 18, p. 288. Gand, Septembre 15, 1912.

An International Horticultural Congress will be held at Ghent in 1913 at the same time as the great battle of flowers. The Congress will include five sections, *viz*: I floriculture and the special processes of forcing plants; II, fruit growing; III, market gardening; IV, science and popularisation; horticultural engincering; V, horticultural economy (trade, transport, association).

For information and entry forms, address M. Rodigas, 79 Avenue Chazal, Brussels.

1494 - **The National Dairy and Cold-Storage Congress at Ghent, Belgium, in 1913.**

Congrès national de Laiterie et du Froid à Gand en 1913. *Revue Générale Agronomique*, New Series, 7th Year, No. 8, pp. 334-335. Uccle-lez-Bruxelles, August 1912.

A National Dairy and Cold-Storage Congress will be held at Ghent during the International Exhibition of 1913.

The following is the programme of the Congress:

Dairy: Section I. — 1. Rapid methods for the control of the purity of lactic fermentation. — 2. The obtaining and preservation of raw milk. — 3. Dairy co-operation, the causes of its success and failure.

Section II. — 1. Control of the milk trade in centres of population. — 2. Improvement in the profits of the dairy industry.

Cold-Storage: Section I. — 1. Cold-Storage depôts for meat, poultry, salted provisions, eggs. — 2. Laboratories for research on the subject of cold-storage. — 3. Applications of cold-storage to the fishing industry. — 4. Applications of cold-storage in brewing.

(1) See No. 1262, *B* Sept. 1912. (*Ed.*).

Section II. — 1. Application of cold-storage to the treatment and preservation of milk, butter and other dairy products. — 2. The preservation of fruit, flowers and vegetables by cold-storage. — 3. Application of cold-storage to transport.

The corresponding secretary of the Congress is M. O. André, 59 Avenue des Arquebusiers, Brussels.

1495 – **Smithfield Club Show, 1912.**

The Smithfield Club (Incorporated) Show will be held from December 9th to 13th 1912 at the Royal Agricultural Hall, Islington, London, N. The Show will include 42 classes for cattle, 33 for sheep, 22 for pigs, 13 slaughter classes (cattle, sheep and pigs) and 25 classes for table poultry. The total amount offered for competition in ordinary prizes, cups, Champion prizes, etc. is £4428 4*s.* 10*d.*, namely £2123 for cattle, £1223 for sheep, £521 for pigs, £292 for carcase competition, £142 4*s.* 10*d.* for feeders of First Prize animals, and £127 for table poultry.

It is possible for a Steer or Ox to win the following :

	£
1st Prize in its Class (according to Class)	25
Silver Cup, as best animal not exceeding 2 years old	25
Silver Cup, as best of its Breed	25
Silver Cup, as best Steer or Ox in the Classes	50
Gold Medal to Winner of the King's Challenge Cup	15
Champion plate, as best Beast in the Show	105
Gold Medal to Breeder of do.	15
Total	£260

And the King's Challenge Cup for best beast bred by Exhibitor.

For a Heifer it is possible to win equal prizes.

For a Pen of Three Long-Woolled Sheep it is possible to win the following :

	£
1st Prize in their Class (according to Class)	15
Silver Cup, as best of their Breed	15
Gold Medal to Winner of the Prince of Wales ' Challenge Cup	15
Champion Plate, for best Pen of Long-Woolled Sheep	50
Gold Medal to Breeder of do.	15
Total	£110

And the Prince of Wales's Challenge Cup for best Pen of Sheep bred by Exhibitor.

For a Pen of Three Short-Woolled Sheep it is possible to win equal prizes.

A Pen of Pigs could win the following:

	£
1st Prize in their Class	10
Silver Cup, as best of their Breed	10
Gold Medal to Winner of Prince Christian's Challenge Cup	15
Champion Plate, for best Pen of Pigs in the Show	20
Gold Medal to Breeder of do.	15
Total	£70

And Prince Christian's Challenge Cup for best Pen of Pigs bred by Exhibitor.

A Single Pig could win the following:

	£
1st Prize in its Class	5
Silver Cup, as best Single Pig	5
Total	£10

Practical instruction in the best methods of dressing and preparing poultry for the market and table use will be given on the second day of the table poultry show (December 12th.).

1496 – **Agricultural Exhibition in Birmingham, November 30 and December 2 to 5, 1912.**

The sixty-fourth annual exhibition of Fat Cattle, Sheep, Pigs, Roots, Corn and Implements, promoted by the Birmingham Agricultural Exhibition Society, will be held in Bingley Hall, Birmingham, on November 30th and December 2nd to 5th 1912. Further information may be obtained from the Secretary, Mr. W. H. Lythall, Bingley Hall, Birmingham.

1497 – **Exhibition of Australian Products and Manufactures at Launceston, Tasmania, in 1913.**

The Board of Trade Journal, Vol. LXXVIII, No. 826, p. 727. London, September 26, 1912.

An Exhibition of Australian Products and Manufactures will be held at Launceston, Tasmania, for three months from the 1st of January, 1913. The exhibition is promoted by the Australian Natives' Association, under the auspices of the Tasmanian Government, and will include sections for, *inter alia*, textile fabrics of flax, hemp, jute and wool, lace, hosiery, clothing etc.; all kinds of agricultural and pastoral machinery and appliances; mining machinery, tools and appliances; ore reducing and concentrating machinery, etc. All exhibits must be delivered at the exhibition not later than the 10th of December 1912. Further information may be obtained from the Secretary, Mr. G. W. Allen, 17, Victoria Buildings, Cameron Street, Launceston, Tasmania.

1498 - **Agricultural Shows in Jamaica.**

The Journal of the Jamaica Agricultural Society, Vol. XVI, No. 8, p. 452. Kingston, Jamaica, August 1912.

Agricultural Shows will be held at Frankfield in February and at Lambs River on the 27th of March, 1913.

1499 - **Ninth Annual Meeting of the American Breeders' Association.**

The Ninth Annual Meeting of the American Breeders' Association will be held at Columbia, South Carolina, on January 24, 25 and 27, 1913, immediately before the opening of the American Corn Exposition.

Students of Heredity and Eugenics, and improvers and breeders of live-stock, poultry, field, garden and horticultural crops are invited to attend.

1500 - **The Ninth International Congress of Zoology at Monaco, 1913.**

IX Internationaler Zoologenkongress zu Monaco. — *Zentralblatt für Zoologie, allgemeine und experimentelle Biologie*, Vol. I, Parts 6-7, p. 288. Leipzig - Berlin, September 27, 1912.

The Ninth International Congress of Zoology will be held at Monaco from the 25th to the 30th of March, 1913, under the presidency of his Highness Prince Albert of Monaco. The General Secretary of the Congress is Prof. Joubin, Institut Océanographique, 195 Rue Saint-Jacques, Paris.

CROPS AND CULTIVATION

AGRICULTURAL METEOROLOGY.

1501 - **The Action of Forests on Late Frosts.**

CUIF, E. Action de la Forêt sur les Gelées tardives. — *Annales de la Science Agronomique*, Year 29, No. 3, pp. 161-166. Paris, September 1912.

The two methods of forest regeneration, progressive felling and clear felling, having been practised simultaneously and side by side in the domanial forest of Amance, Meurthe-and-Moselle, in France, the writer thought it would be useful to study once more the influence of the forest on late frosts by observing the daily oscillations of the thermometer. He made three posts of observation in 1909 : the first beneath a stand prepared for regeneration and protecting by its shelter a plantation of 5-year old oaks ; the second in the midst of a plot which had been clear felled and re-planted with oaks ; and finally, a third on the edge of the Etang de Brin in the midst of a plantation of exotic trees put in after clear fellimg.

The readings were taken in 1909, 1910, and 1911, eight times during each of the three months of April, May and June, for late frosts often occurred during the second fortnight in May. These returns figure in a table, which shows once more that the forest reduces the maxima and increases the minima of the temperature of the air. They are, further, interesting from a special and practical point of view, since in two years out of three,

the frosts wrought havoc in plantations made after clear-felling, while the oaks planted under shelter were unharmed. It is just during this second fortnight in May, that the approach of the extreme limits of temperature towards one another is most marked under the trees, and this diminishes the risk of late frosts.

The table published by the writer for this period of the year gives the following temperatures:

Dates	Stations	1909		1910		1911	
		Max.	Min.	Max.	Min.	Max.	Min.
		°C.	°C.	°C	°C.	°C.	°C.
May 22	Forest	+ 25.5	+ 0.5	+ 26.5	+ 10.2	+ 18.8	+ 1.5
	Nursery	+ 27.0	— 3.0	+ 29.5	+ 8.5	+ 22.0	— 3.0
	Pond	+ 32.3	— 2.0	+ 33.0	+ 8.0	+ 29.5	— 3.0
May 26	Forest	+ 30.0	+ 7.2	+ 23.0	+ 9.0	+ 21.2	+ 5.0
	Nursery	+ 32.2	+ 5.7	+ 25.7	+ 5.0	+ 26.7	+ 0.5
	Pond	+ 34.7	+ 4.5	+ 29.0	+ 5.5	+ 32.0	+ 1.2
May 29	Forest	+ 19.0	+ 2.2	+ 22.7	+ 7.5	+ 24.7	+ 7.0
	Nursery	+ 21.0	— 1.2	+ 27.0	+ 3.5	+ 30.0	+ 2.5
	Pond	+ 27.0	— 0.5	+ 32.5	+ 2.8	+ 35.5	+ 2.8

To appreciate justly these two methods of artificial regeneration, the inconveniences of open plantations, *viz.*, drying of the soil, weeds, loss of growth in height and deformation of the trunks, must be balanced against the disadvantages to which sheltered plantations are exposed: slow growth of vegetation due to want of light and the greater or less disturbance caused to the young trees by the gradual removal of the old stand.

AGRICULTURAL GEOLOGY.

1502 – A Contribution to the Knowledge of the Black Cotton Soils of India.

HARRISON, W. H. and SIVAN, M. R. RAMASWAMI in *Memoirs of the Department of Agriculture in India*. Chemical Series, Vol. II, No. 5, pp. 261-280, 4 plates. Calcutta-London, September 1912.

Diverse theories have been put forward to account for the peculiar colour and properties of the regur or black cotton soils of India. These

discussions have been summarized in the publications of Leather (The Composition of Indian Soils, *The Agricultural Ledger*, 1898, No. 2) and Annett (The Nature of the Colour of Black Cotton Soil. *Memoirs of the Department of Agriculture in India*, Vol. I, No. 9). In general the black colour of the soils is accounted for 1) by the presence of organic matter either in the form of humus or in peculiar combination with iron, or 2) by the presence of a black mineral common to these soils wherever they may be found. Leather and Annett have shown that only a proportion of the black colour is due to organic matter, and with this conclusion the writers' observations are in entire agreement. Annett is of the opinion that the colour of the regur is mainly due to the presence of titaniferous magnetite and that these soils are formed from trap rocks. However, trap rocks are to be found in the provinces of Madras and Bombay, but they occur in South India only in the form of occasional dykes.

The regur occurs in many localities and in close relationship with many diverse geological formations; consequently it varies somewhat in colour, working properties and fertility. Yet it possesses the common characters of being highly argillaceous and somewhat calcareous, of becoming highly adhesive when wetted, of forming deep cracks in the dry season, and of being everywhere similar in chemical composition. On the other hand, some decided differences are apparent in the different localities. The sand formed in the water-courses and gullies draining the black cotton soils of the trap area contains a large proportion of black sand, whereas the corresponding sands from the soils overlying metamorphic rocks is white in colour or, if coloured, is reddish, owing to the presence of garnets. This fact is easily demonstrated by separating the coarse particles from the different soils by means of a 90 mesh sieve after preliminary treatment with acid to decompose carbonates. The black cotton soils of the Guntur District, on treating as above described, yielded a pure white sand, whereas when the acid treatment was omitted, a large quantity of a very black "sand" was obtained. The black soils of the Bellary, Kurnool and Tinnevelly Districts are practically devoid of black magnetic minerals. Convinced of the necessity of extending and generalizing observations, the writers examined samples of soils from the Bombay Presidency and from the Central Provinces; they inspected also the soils of Tinnevelly and Ramnad in the extreme South of the Peninsula and those of Bellary through the Kurnool District to Guntur. The method adopted after several preliminary experiments was to treat 10 grams of soil with 1 per cent. hydrochloric acid to decompose carbonates, and then to carry out the method of "cradling" described by Annett, taking care, however, not to carry it too far, the object being to remove the lightest and finest particles only. The residue obtained was dried and the heavier solids removed by allowing them to settle from a solution of cadmium borotungstate having a sp. gr.

of 3.2. The separated solids were washed, dried and weighed and then a further separation was performed by removing any magnetic particles by means of a magnet. The average results thus obtained are tabulated below:

PLACE	% of particles over 3.2 sp. gr.	% of magnetic particles over 3.2 sp. gr.	Ratio $\frac{\%\text{ magnetic}}{\%\text{ non magnetic}}$
Soils from Tinnevelly and Ramnad Districts	1.029	0.012	1:85
Soils from Bellary District	0.362	0.022	1:15
» the metamorphic area of the Guntur District	0.397	0.03	1:12
Soils from the Nandyal Valley	0.216	0.017	1:12
» the Palnad Taluq, Guntur District	0.01	0.01	—
» trap areas	3.06	1.02	1:2

The soils overlying the Cuddapah formation are similar in every respect to those of the Nandyal valley.

It is clearly apparent that it is possible to divide the regur soils into several types depending 1) upon the percentage of particles of high specific gravity, 2) the percentage of heavy magnetic particles, and 3) the proportion of heavy magnetic particles to the heavy non-magnetic particles. This is made more prominent by a microscopical examination of the particles over 3.2 sp. gr., which shows that the minerals present in a soil are distinctly related to those of the underlying formations. This relationship points to the conclusions that regur soils, although possessing common agricultural characteristics, are derived from many diverse rock formations and that they are of comparatively local formation, any transportation which may have taken place usually appearing to have been confined to a limited area.

The main result brought out by the writers' investigation is the fact that titaniferous magnetite, to which Annett attributes a large proportion of the colour of regur soils, is only found in quantity in the soils from the trap areas, and that the soils of the Madras Presidency are practically devoid of this substance. Hence the writers instituted a series of experiments to determine the presence of any substance common to all, to which the cause of the black colour could be referred. The conclusions arrived at from the results are as follows: 1) The colour and peculiar physical properties of black cotton soils are associated with the compound particles of low specific gravity, which are found in all these soils. 2) Two classes

of substances have been recognized as conferring the colour and physical properties. One is probably a colloidal hydrated double iron and aluminium silicate, which is mainly concerned with the formation of compound particles and which possesses, in a modified form, the properties of ordinary clay. The other is organic in character and may possibly be an organic compound of iron and aluminium.

SOIL PHYSICS, CHEMISTRY AND MICROBIOLOGY.

1503 – Observations on the Behaviour of the Principal Mineral Constituents of the Soil as regards Evaporation.

PRINCIPI, PAOLO. — Alcune osservazioni sul comportamento rispetto all'evaporazione dei principali costituenti minerali del terreno agrario. — *Giornale di Geologia pratica*, Year X, Part I, pp. 14-20, 4 figs. Parma, 1912.

The data on the behaviour of the three principal constituents of the soil — sand, limestone and clay — towards the water that they absorb are of immediate practical utility for the application of agricultural hydrology and especially for irrigation.

When a moist soil is exposed to the air, direct evaporation takes place almost exclusively from its surface or from a very short distance from the same: the interior of the mass of soil loses its moisture through capillarity which conveys the water through the pores from the centre towards the outside.

The writer has investigated evaporation, accompanied by capillarity, in the following soils each taken separately: very fine quartz sand; sand passed through a sieve with ¼ mm. mesh (one hundredth of an inch); powdered limistone; limestone passed through a sieve with ¼ mm. mesh; and pure clay. These various substances were saturated with water and then placed in wire netting cubes the sides of which measured 2 inches. These cubes were then suspended in such a way as to be completely surrounded by air, and weighed every day until they showed a constant weight. During the experiment the temperature ranged from 12° to 15° C. The progress of the experiment is represented by a diagram which shows that:

1. Among the mineral constituents of the soil, clay requires the longest time to dry.

2. The constant weight is reached in the shortest time by limestone and by the quartz sand passed through the hundredth of an inch meshed sieve.

3. The dimensions of the particles have a considerable influence on the phenomenon, because the time required for drying up increases inversely with the size of the soil particles.

4. The rate of evaporation diminishes brusquely at a certain moment, after which it proceeds slowly and diminishes gradually. This brusque diminution is due to the fact that on the surface of the various substances

a dry layer is formed, which hinders the various capillary currents which tend to lead the water from the interior towards the outside.

The above experiments were repeated at the same temperature for several artificial soils constituted by various proportions of quartz sand, clay and calcareous material, and the results confirmed those previously obtained.

The writer studied also the process of evaporation in the single mineral components of the soil without taking capillarity into account. In this investigation he used glasses, measuring 3 inches in diameter, the lower part of which (*B*) was filled with water or with the wet material; $^3/_4$ of an inch above this the same dry material was placed to a depth of $^3/_4$ inch (*A*) on a linen cloth resting on a wire net. The water that was evaporated from the surface of *B* was thus obliged to pass through the upper dry layer *A*, while the intervening air-space prevented the water ascending by capillarity. The experiment was conducted at a temperature of 15°C. with 11 glasses. Of these, 5 contained water in *B*, and in *A* the following substances: powdered quartz sand, quartz sand passed through the ¼mm. sieve, powdered limestone, limestone passed through the above sieve, and clay. In five other glasses part *A* remained unchanged, whilst part *B* was occupied by the same materials as *A* but containing water according to their capacity of absorbing it. In the eleventh glass nothing was placed on the linen resting on the wire net in order to ascertain the amount of free evaporation. The experiment was continued for 60 days. The amount of water evaporated by the 11 vessels is shown by a diagram. From the results the writer draws the following conclusions:

1. The greatest loss of water takes place through those materials in which the pores are largest.

2. The quantity of water which is lost by evaporation remains almost the same whether it arises from a free surface of water or from the thin films that cover the particles of the wet material.

This must depend upon the fact that the air spaces in both cases become saturated with water vapour which traverses the upper layer of dry meterial in obedience to the same laws that govern the diffusion of air and of other gases.

It is understood that the rapidity of evaporation is intimately connected with the depth *A* of the material used, with the surrounding temperature, and with the atmospheric moisture and pressure.

With a depth *A* of 1 $^3/_4$ inches and a temperature of 15° C. in one year the amount of evaporated water would have been:

Through	powdered quartz sand	6.89	inches
»	quartz sand passed through $^1/_{100}$ in. sieve	7.40	»
»	powdered limestone	6.77	»
»	limestone passed through above sieve	7.24	»
»	clay	6.30	»
Whilst the evaporation in the open would have been		22.99	»

1504 – The Chemistry of Steam Heated Soils.

SCHREINER, O. and LATHROP, E. C.: Contribution from Laboratory of Soil Fertility Investigations, U. S. Department of Agriculture in *The Journal of the American Chemical Society*, Vol. XXXIV, No. 9, pp. 1242-1259. Easton, Pa., September 1912.

The writers undertook an investigation to determine the effects of steam heating, as in sterilization(1), on the chemical composition of soils, with special reference to the nitrogenous constituents of the organic matter. The two soils examined (known as Elkton silt loam and Sassafras silt loam) were decidedly different in physical and chemical characteristics, and in fertility, but had the same geological origin. The amounts of organic matter and the forms in which its nitrogen occurred were very similar, so that only actual isolation of the various compounds composing the organic matter could show where the difference lay.

The soils were heated in an autoclave at a pressure of 30 lbs. for 3 hours, at a temperature of about 135°. The extraction with 2 % sodium hydroxide was made as soon as they had cooled ; only the alkaline extract (in which the organic compounds rendered soluble by heating would occur) and the acid filtrate from the humus precipate were studied in detail.

The writers summarize the results as follows :

1) There was an increase in water-soluble constituents and an increase in acidity, even though at the same time ammonia and amines were formed.

2) By the process of heating there was an increase in nearly all of the nitrogenous constituents of the organic matter isolated from the unheated soil except perhaps nucleic acid.

3) Both beneficial and harmful compounds were produced by heating the soils and were isolated.

4) By the process of heating there were formed xanthine, hypoxanthine, guanine, cytosine, and arginine, when not previously existing. These compounds are decomposition products of nucleic acid and protein material and are all beneficial to plant growth.

5) Dihydroxystearic acid was increased when present, and was produced by the heating process when not previously present. This compound is harmful to plant growth.

6) Cultural tests in the soils and their extracts showed that the heated soils gave a poorer plant growth.

7) Although the majority of the compounds formed must be classed as beneficial, the harmful compound formed more than overbalances their effects. Not until this harmful compound is eliminated or diminished can the full beneficial effects of heating be shown.

(1) See No. 485, *B.* March 1912. (*Ed.*).

8) In soils there is a balance of beneficial and harmful factors, soil fertility or infertility being the resultant of two groups. As one or the other group of factors gains the ascendancy, the fertility is raised or lowered as the case may be. This balance is influenced by cultural treatment, fertilizers, liming, crop growth or crop rotation, etc., as well as by steaming.

9) The results show that although the soils studied have received the same kind of organic matter and have received the same farm treatment, they have been subject to different biochemical factors resulting in differences in their organic matter and in differences in their fetility.

1505 - **Causes determining Infertility of Soils and Loss of Crops.** — See below, No. 1572.

1506 - **Bare Fallows and Half Fallows in Central Russia.**

TILLAGE AND METHODS OF CULTIVATION

TOPORKOFF, S. (Saniatie Pari v Zentralnikh Chernozemnekh Guberniakh) *Selskoie Khoziaistvo i Liesovodstvo* (Agriculture and Forestry), Year LXXII, Part 7, pp. 306-330. St. Petersburg, 1912.

The question of bare *versus* root or fodder crop fallow is one of the greatest importance in Russia, especially in the central part of the black earth (chernoziom) region. With the object of studying this problem numerous experiments were made at the Shatilov Experiment Station, where care was taken to render the tillage and manuring of the soil as uniform as possible in order that the effect of the various kinds of fallowing should show clearly in the final results. But, as it appears from the considerations of the writer, this method does not always allow of exact deductions : In the case of bare fallow and root-crop (potato) fallow the time at which the successive rye is sown, and the density of the sowing — a most important factor in the success of the crop — varied considerably in their " optimum " effect, and by adopting the same rules in all cases the risk would be incurred of attributing to the fallow what in reality is the effect of too dense or untimely sowing. It is therefore necessary to determine for each locality and for every kind of fallow which are the best conditions of tilling, manuring, etc., in order to ensure a good crop. Theoretically speaking it is known that on a well-tilled fallow with a high water and plant food content, winter cereals must be sown late and thinly. This is also followed in practice : supposing the time for sowing to extend over 12 days, during normal weather, the second half of this period is preferred, while in the case of annual or perennial fodder-crop fallows the first half, or six days earlier, is chosen.

As for the quantity of seed sown it must be all the more abundant the more unfavourable the environing conditions are to the tillering of the young plants.

The same may be said for the time and extent of manuring and of tilling. Many of the negative results obtained at Shatilov with root or fodder crop fallows are due to the fact that the same rules were applied to these fallows as to the bare ones.

How important for root or fodder-crop fallows an early ploughing and seeding may be, is shown by the following data relating to a root-crop (potato) fallow:

Date of ploughing	Date of sowing	Rye harvested cwt. per acre
Sept. 8	Sept. 18	18.32
» 28	Oct. 8	14.34
Oct. 18	» 28	7.17
» 28	Nov. 7	(destroyed by frost)

If in the black soils, and especially in the Government of Tula, the second week of August is considered to be the most favouralble moment for the sowing of rye on bare fallow, in the case of root or fodder-crop fallows sowing should be carried out in the first week of that month.

The following table gives the data collected at Shatilov during the years 1906-7 and 1908-9 on the rye crop. The figures are in cwt. per acre.

Date of sowing	Farmyard manure			Phosphates			Without manuring		
	Bare fallow	Leguminous fodder-crop fallow	Root-crop (potato) fallow	Bare fallow	Leguminous fodder-crop fallow	Root-crop (potato) fallow	Bare fallow	Leguminous fodder-crop fallow	Root-crop (potato) fallow
Aug. 8, 1906 . .	19.11	17.52	15.93	18.32	16.72	15.13	17.52	15.13	13.54
» 18, 1908 . .	14.34	13.54	13.54	15.93	13.14	11.95	15.93	11.15	10.35

The summers of 1907 and 1909 had the same character: temperature and rainfall were very favourable to the growth of rye; the autumn of 1908 on the contrary was distinguished by its low average temperature, which by shortening the period of vegetation reduced the yield in grain. This disadvantage might have been avoided by sowing earlier; as this may and, according to what has been previously said, should be carried out a week earler in the root and fodder-crop fallows, the increase of the yield in grain would have been very considerable.

The writer, besides giving many data on yields of the forage crop (from the leguminous fodder-crop fallows), of the rye and oats grown after bare

and after the other fallows, draws up a fairly exact account of the expenses in both cases, and concludes, at least for the central part of the "black soil", in favour of the leguminous fodder-crop fallow.

It is also to be remembered that these plants improve the physical conditions of the soil, increasing its productivity and, in the districts where the three years' rotation without farmyard manure prevails, preserve the nitrogen reserves of the soil,even when phosphatic manures are continuously used.

The uniformity of tilling, manuring, etc., renders the drawing of conclusions still more uncertain in the case of potato fallow as compared with bare fallow. And as potatoes dry the soil a good deal, all the cultural operations which tend to limit evaporation must be carried out in preparing the soil for rye. Further, the soil, after the potatoes have been lifted, remains full of spaces and tends to settle slowly, leaving the node from which tillering starts, and which in rye forms very near the surface, out of the ground. It is therefore advisable in preparing the land for sowing to avoid deep ploughing, which prolongs and intensifies this process of settling. The following figures illustrate this point:

Preparation of the soil	Yield of rye cwt. per acre
1) Deep ploughing	15.13
2) Medium »	17.52
3) Shallow »	23.90
4) No »	23.90

The negative results obtained at Shatilov with potato fallows may be explained as a consequence of the improper methods of tillage: deep ploughing, etc. But if a poor crop of rye were to follow even the best methods, it would always be possible to grow another crop instead of rye, spring wheat for instance. Something has already been done in this direction in the Government of Tula, where the most intelligent farmers are beginning to replace bare fallows by potato fallows followed by spring wheat.

With these researches and considerations the writer does not claim to have resolved the question of fallows, but only to have made evident how important and complicated it is and how worthy of many and well conducted experiments. In the two cases examined: leguminous fodder crop fallow and potato fallow followed by spring wheat, the results obtained are all in favour of these as against bare fallows.

MANURES AND MANURING.

1507 - The Action of Green Manure Plants in the Soil and their Comparative Usefulness.

1. DUMONT, J. Sur la nitrification des engrais verts. — *Annales de l'Ecole nationale d'agriculture de Grignon*, Vol. II, pp. 80-82. Paris, 1911 (1912).

2. CORSO, G. Influenza dell'acidità delle piante da sovescio nell'utilizzazione dei fosfati insolubili. — *Annali della R. Stazione Chimico-Agraria Sperimentale di Roma*, Series II, Vol. V (1911), pp. 123-132. Roma, 1912.

Experiments were made by the Agricultural Station of Grignon on the different nitrifying powers of lupins and mustard as green manure.

From 1905 onwards twelve successive crops of lupins and mustard respectively were embedded in the soil of two pots ; the lupins were at the rate of 79 575 lbs. of green substance and 1670 lbs. of nitrogen per acre, and the mustard at 120 420 lbs. of green substance and 1600 lbs of nitrogen.

On comparing the nitrogen lost in the drainage waters in both cases, it is found — disregarding the quantity of water drained — that it varies considerably: with the lupins the average is 132 mgr. per litre, but with mustard it is only 20 mgr. per litre. This very substantial divergence is due to the different nitrifying powers of the two green manures. In point of fact, assuming a grade of nitrogen in the dry substance of 2.1 per cent. in the lupins and 1.3 per cent in the mustard on the average, it is found, even allowing for that of the drainage water, that the intensity of nitrification of the lupins is at least four times as great as that of the mustard. It follows that under similar conditions of environment the mineralisation of a humus on a mustard basis will take place more slowly than with lupins, which must be preferred, just like other easily humifying and nitrifying leguminous plants, when a rapid utilisation of the green manure is aimed at.

Green manure experiments were carried out in the experimental field of the Royal Station of Agricultural Chemistry of Rome with special reference to the utilization of phosphates. There were two series :

I. LEGUMINOSAE.	II. CRUCIFERAE.
Vetches (*Vicia sativa*).	Black mustard (*Sinapis nigra*).
Vicia narbonensis.	White mustard (*S. alba*).
Beans (*Vicia Faba* var. *minor* and var. *major*).	Rape (*Brassica campestris* and *B. Napus*).
Lathyrus Cicera,	
L. sativus.	

The plants were sown at the end of October 1910 and ploughed in in February and March 1911; maize then followed. The soil used contained 2.57 per thousand of phosphoric anhydride soluble in nitric acid, and 0.23 per thousand soluble in citric acid ; for control, in addition to the

bare patch, three other plots were respectively treated with superphosphate, basic slag and Gafsa phosphorites, at the rate of 71 lbs. of phosphoric anhydride per acre. At the time of ploughing in, the natural acidity of the stem and roots of the plants was determined by extraction with boiling water. From the data thus obtained and those of the yield of maize, the following appears :

a) The powers of the green manure in rendering soluble the phosphoric acid of the insoluble phosphates varies according to the family of plants.

b) The Cruciferae, with a relatively low acidity, turn to equal account, and under equal conditions of acidity to better account than the Leguminosae, the phosphoric acid applied to the soil.

c) For the same species of plants, a higher acidity represents a greater power of bringing insoluble phosphoric acid into solution ; finally, as the acidity of the plants is in direct ratio to their hardiness, it must be held that the hardier the plants the more they utilise the insoluble substances of the soil, both owing to the greater acidity of the juices and the wider spread of their roots.

Practical Conclusions. As regards the technical application of green manure in agriculture, it must be held that :

1). With lupins and Leguminosae generally, there is a more rapid utulization of the green manure, especially from the point of view of nitrification.

2). The crucifers as green manure turn the phosphoric acid in the soil to better account than the Leguminosae.

3). Generally, there is every reason for ascertaining by experiment the manurial value of the different green manure plants, it being a great mistake to think that all plants ploughed in green have the like properties for improving the chemical and physical conditions of the soil.

1508 – **New Observations on the Behaviour of Nitrates in Arable Land.**

VOGEL. Neue Beobachtungen über das Verhalten von Nitrat in Ackerboden : II. Mitteilung : (from the Department of Agricultural Chemistry, Bacteriology and Seed Selection in the Kaiser Wilhelm Agricultural Institute at Bromberg). — *Die Landwirtschaftlichen Versuchs- Stationen*, Vol. LXXVII, Parts III and IV. Berlin, September 30, 1912.

The writer gives the following summary of the conclusions he has arrived at as the result of exhaustive and lengthy experiments on the behaviour of nitrates in arable land :

1. — The opinion hitherto held that nitrate of soda remains for a long time more or less unchanged in unploughed land, which is protected from leaching, is not universally correct. It far more frequently happens that a rapid and extensive decomposition of the nitric salts in the soil sets in. During this decomposition oxides of nitrogen of different kinds

are formed, probably also at times nitrogen and ammonia ; these processes are therefore attended by loss of nitrogen.

2. — The conditions for such a decomposition of nitrates in the soil occur when the nitric salts are distributed over very shallow layers of soil and a certain amount of water is present for some time ; in average soils this amount is between 15 and 20 %, but in some cases may be more or less. If it is so high that the soil will turn up steely, the decomposition of the nitrates ceases.

3. — The above destruction of nitrates is of a purely chemical nature and represents a typical reaction at the surface of the soil particles (Oberflächenreaktion) in which, perhaps, the colloidal-chemical processes taking place at the points of contact of the particles play a part. Micro-organisms have nothing to do with the reaction.

4. — The reaction sets in after a short time and may reach its maximun after three to four days. Externally, soils in which nitrate decomposition is in progress are distinguished usually by their dry appearance, powdery consistency, and slow settling after working up with water.

5. — The reaction occurs in all mineral soils hitherto examined, whether it is a case of pale or dark, light or heavy soil. The humus content can thus scarcely be the agent causing or determining the process.

1509 - A New Departure in the Manufacture of Agricultural Phosphates

The Engineering and Mining Journal, Vol. 94, No. 9, pp. 385-386. New York, August 31, 1912.

Hitherto the chief process for rendering the phosphoric acid of crude phosphate materials available as plant food, has been grinding the rock and treating it with sulphuric acid, which changes the insoluble phosphate into a soluble form. Depending upon the composition of the original material, *i. e.* the amount of certain basic impurities present, and upon the strength of acid used, etc., some of the phosphoric acid " reverts " into a form which is not soluble in water. The agricultural chemists, however, have agreed that treatment with a solution of ammonium citrate of given strength, applied under given conditions, closely imitates the action of the roots in dissolving " reverted " phosphoric acid.

Now, Spencer B. Newberry — an expert authority in matters relating to the manufacture of cement — has for some years been making experiments to ascertain what is the effect of calcination at high temperatures upon the crude phosphate rocks of commerce. He discovered that the calcination of ground phosphates alone, if carried out under suitable conditions, rendered the phosphate in most crude rock " available " or citrate soluble, and submission of samples to agricultural stations proved that chemically and agriculturally it is as "available" as the "reverted" phosphate which results from the solution in acid. Mr. Newberry and his asociate

furthermore discovered that the addition of many substances to the ground phosphate rendered the calcination quicker, more thorough and more regular in its product. He found that sulphuric acid, coal dust, common salt, sulphate of lime, sulphate of soda, etc., all produced these results, but that the best effect was produced when "salt cake," which is a byproduct of many processes, was used. An increase of the heat, after the effect desired has been produced, drives off by volatilization the alkaline salt, leaving the phosphate not only available to the citrate test, but in a concentrated form.

When the phosphate is decomposed in the old process by 50° acid, sulphate of lime is formed, which dilutes the product, so that a phosphate containing for instance 30 per cent. of total phosphoric acid, will yield a product containing only from 15 to 16 per cent. of soluble or "available" phosphoric acid; whereas repeated experiments obtained in many laboratories, have shown that rock running 32 per cent. total phosphoric acid yielded, by the Newberry process, a product averaging over 30 per cent. of "available." There seems to be no question as to this fact, for there are reports from a number of State agricultural stations and from other reputable laboratories in the United States confirming this statement.

Many patents have been applied for: those covering the use of alkaline phosphates, alkaline carbonates, sulphuric acid, etc., have been granted. The one covering the use of alkaline sulphates has been allowed but not issued, and other patents are being considered at the U. S. Patent Office. Patents have likewise been granted in Belgium, Great Britain, France, Germany and other countries.

Should further experiments on a large scale confirm the availability of this product for manuring, it should serve as a means of making complete fertilizers containing a large percentage of available phosphate, undiluted with sulphate of lime. It would also mean a considerable diminution in the amount of the sulphuric acid employed at present for making superphosphates, which acid is now employed to the extent of many million tons throughout the civilized world annually. It seems as if the Newberry product were similar to that obtained from basic slag (1).

It is perhaps too early to say anything upon the subject of cost as compared with that of the superphosphate, but the product being about twice as rich in "available" phosphoric acid, there will at least be a saving in transportation and other handling.

(1) In this connection Wiborgh phosphate and other similar new products should be considered. *Cf.* v. FRELTZEN, H. Nagra ord om Fosfatindustrien och dess nuvarande standpunkt i vart land. Pp. 40. Göteborg, 1912. See also No. 898, *B.* June 1912. (*Ed.*).

1510 – The Value of the Materials used in the Agricultural Production of Great Britain

1. REW, R. H.: The Agricultural Output of Great Britain, — *Report on Enquiries Made by the Board of Agriculture and Fisheries in Connection with the Census of Production Act, 1906, relating to the total output of Agricultural Land, etc., passim.* London, 1912.
2. CENSUS OF PRODUCTION (1907). — *Preliminary Tables*, Summarising the results of the Returns received under the Census of Production Act, 1906. Part III, (25) (26) (27). London, 1910.
3. Government Inspector's Report, 1911, on Chemical Manure Works. — *Mark Lane Express Agricultural Journal*, Vol. 108, No. 4219, p. 247. London, August 5, 1912.
4. HENDRICK, J. Artificial Manures. — *The Standard Cyclopedia of Modern Agriculture and Rural Economy*, Vol. 1, pp. 207-212, and *passim*. London, 1908.
5. HALL, A. D.: Fertilisers and Manures, *passim*. London, 1909.
6. BEAR, E. W.: Import of Manures into Great Britain. — *Journal of the Royal Agricultural Society of England*, Vol. 70, pp. 151-163. London, 1909.
7. See No. 1151, *B.* Aug. 1912

I. — *General.*

According to the Report on Inquiries made by the British Board of Agriculture in connection with the Census of Production Act, 1906, the total "output" of the agricultural land of Great Britain is represented by the value of the products sold off the farms for consumption. Thus the total value of the farm crops grown in 1908 is calculated (at market prices) at £125 000 000, of which £46 600 000 represents the portion actually sold. The remainder — except for a comparatively small proportion consumed in the households of the farmers themselves — went to feed the stock and maintain the fertility of the land. The actual or "consuming" value of this larger portion of the farm crops is thus dependent on its realisation in other forms.

A calculation of the "estimated value of the materials used" in producing the total "output" (calculated for Great Britain at £150 800 000) is then largely speculative. While about two-thirds of the crops are returned to the land, and the consuming or manurial value of these crops might be calculated as a part of the cost of materials used in producing the "output," for purchased material more definite information is available in the returns collected by the British Board of Trade.

II. — *Artificial Fertilisers and Feeding-stuffs.*

The Preliminary Tables which summarise the returns received by the Board of Trade under the Census of Production Act contain information concerning the output of manufactured feeding-stuffs and artificial fertilisers, which, considered in connection with the particulars concerning the imports and exports of the United Kingdom collected by the Commissioners of Customs and Excise, and the imports and exports of Ireland collected

by the Department of Agriculture and Technical Instruction, enables a calculation to be made of the total value of each of these classes of products available in 1907 for use on the farms of Great Britain. Owing to the fact that it was necessary for the detailed particulars of the production to be given for the United Kingdom only in some instances, in order that the output of a few firms in Ireland might not be revealed, to the duplication of returns of production in certain instances where the product of one factory becomes the raw material of another, and also to the absence of published exact statistics of importation and exportation to and from Great Britain apart from the United Kingdom, the results here presented must be regarded as approximate, and they are also subject to revision when the final figures of production are published by the Board of Trade.

A. Manufactured Feeding-stuffs.

These may be conveniently classed as (*a*) Corn Offals and Feeding Meals and (*b*) Oilseed Cake and other feeding stuffs.

a) *Corn Offals and Feeding Meals.*

1) *Home Production.* — These were produced in grain-milling factories, in brewing and malting factories, and in spirit distilling factories; and the output in Great Britain in 1907 was as follows:

	Cwts.	£.
Grain-milling factories:		
Wheat offals	35 441 000	8 007 000
Oatmeal offals	415 000	65 000
Barley meal and flour	5 969 000	
Bean meal and split beans	1 145 000	6 358 000
Maize meal and milled products of maize (other than offals)	8 703 000	
Other sorts of meals (including oil-cake meal)*	2 227 000	
Provender and feeding stuffs	1 663 000	594 000
Offals (other than wheat and oat offals)	224 000	60 000
Brewing and malting factories:		
Grains, malt-combings, and other offals	—	984 000
Spirit distilling factories:		
Offals and other waste products	—	253 000
Total Value	—	16 321 000

* The amount of oil-cake is small.

In the above table the value of wheat offals produced in Great Britain has been calculated on the assumption that it bears the same proportion to the total value for the United Kingdom (£8 563 000) as the quantity produced in Great Britain (35 441 000 cwts.) bears to the quantity produced in the United Kingdom (37 901 000 cwts.).

2) *Net Exports in* 1907. — The products included in the following table are bran and pollard, rice meal and dust, sharps and middlings, other offals, barley meal and flour, rye meal and flour, buckwheat meal and flour, maize meal and milled products of maize other than offals.

	Cwts.	£.
Total imports into United Kingdom	3 582 000	876 000
Deduct imports into Ireland from Great Britain and places abroad	2 143 000	516 000
Imports into Great Britain, less exports from Great Britain to Ireland	1 439 000	360 000
Total exports from United Kingdom	5 197 000	1 266 000
Deduct exports from Ireland to Great Britain and places abroad	593 000	119 000
Exports from Great Britain, less imports into Great Britain from Ireland	4 604 000	1 147 000
Net exports from Great Britain to Ireland and abroad	3 165 000	787 000

3. — *Consumption in Great Britain.* — The net value of corn offals and feeding meals available for consumption in Great Britain, after deducting the net exports from the total production in 1907, was therefore £15 534 000. The quantity cannot be exactly stated.

b) Oil-seed Cake and other Manufactured Feeding-stuffs.

1) *Home Production.* — The greater part of these products are the output of seed-crushing factories. Details for Great Britain are not separately stated, in order to avoid the possible disclosures of particulars relating to the few firms in Ireland ; moreover, the seed-crushing firms were not required to give separate particulars concerning their different classes of production, though such particulars were supplied voluntarily by a very large proportion of the firms.

The gross output of the trade in the United Kingdom consisted of 1 362 000 tons of oil, oil-cakes and sundries, valued at £12 815 000. Of this total, firms whose output was valued at £11 901 000 returned the production of oilseed cake, unsweetened, shown in the following table. The estimated production of the United Kingdom is calculated on the assumption that the production of the remaining firms (valued at £914 000) consisted of similar proportions of the different kinds of cake.

Oil-seed cakes, not sweetened	Output of firms giving particulars	Estimated output of United Kingdom.
	tons.	tons.
Cotton-seed	485 000	522 000
Linseed	231 000	249 000
Rape-seed	33 000	36 000
Other sorts	58 000	62 000
Total	807 000	869 000

(*) Including a small amount of oil-seed meal, most of which is, however, classed as "cattle foods."

The Census tables do not give the value of the output of oil-cake separately, and it has therefore been calculted on the basis of the average annual prices of cotton-seed and linseed cake extracted from the "Corn Trade News" and from the average export value of British-produced rape-seed and "other sorts" of cake. These were as follows for 1907: London-made linseed oil cake (ex-mill), £7 14s. 6d. per ton; cotton cake, £4 17s. 6d; rape-seed cake, £4 18s.; and "other sorts," £6 10s. per ton. The estimated total value of the United Kingdom output was as follows:

	£
Cotton-seed cake	2 545 000
Linseed cake	1 924 000
Rape-seed cake	176 000
Other sorts of cake	403 000
Total Value	5 048 000

Nearly the whole of this production was the output of seed-crushing factories in Great Britain, and the round figure of £5 000 000 may be taken as the total value for Great Britain.

Animal foods were also produced in other factories, such as fertilizer, biscuit, cattle, dog and poultry food factories; full particulars are not shown in the preliminary tables of the Board of Trade, and it is stated that "it is not possible to state the total selling value of all the animal foods (other than oil-seed cakes and grain offals) made in the United Kingdom . . . but it was not less than £2 028 000." It is pointed out that the compound foods are to a large extent manufactured from oil-seed cakes made at seed-crushing mills. The extent of the duplication is not known. Allowing for this duplication, the total output of oil cake and meal and animal foods in Great Britain may be placed at about £ 6 000 000.

2) *Net Imports in* 1907. — The products included in the following table are cotton-seed, linseed, rape seed and other sorts of oil-seed cake and meals and cattle foods:

	Tons	£
Total imports into United Kingdom	361 000	2 287 000
Deduct imports into Ireland from Great Britain and places abroad	67 000	453 000
Imports into Great Britain from abroad, less exports from Great Britain to Ireland	294 000	1 834 000
Total exports from United Kingdom	65 000	376 000
Deduct exports from Ireland to Great Britain and places abroad	5 000	29 000
Exports from Great Britain to places abroad, less imports into Great Britain from Ireland	60 000	347 000
Net imports into Great Britain from Ireland and abroad	234 000	1 487 000

3) *Consumption in Great Britain.* — The total stock of oil-seed cake and meals and of other manufactured cattle foods, comprising the sum of the home production and net imports, was thus valued for 1907 at approximately £7 500 000. The quantity cannot be exactly stated.

c) Summary.

	Total production	Net exports	Total consumption
	£	£	£
Corn offals and feeding meals	16 321 000	787 000	15 534 000
		Net imports	
Oil-seed cake and other manufactured stuffs .	6 000 000	1 487 000	7 487 000
Total Value	22 321 000	700 000	23 021 000

B. Artificial Fertilisers.

1) *Home Production.* — The quantity and value of the home production in the United Kingdom in 1907 are shown in the following table, which summarises the production of fertilizer factories, chemical factories, oil factories, coke-works, oil-shale works, gas-works, and iron and steel factories. In the case of basic slag, however, the production given represents that of fertiliser factories only, as the output of basic slag by iron and steel factories is understood to consist of the raw material for fertiliser factories, though some uncertainty exists as to whether it may not also include a quantity of ground slag ready for use as manure.

	Tons	£
Basic slag	203 000	278 000
Superphosphates	603 000	1 320 000
Sulphate of ammonia	260 000	2 823 000
Other manures	492 000	2 250 000

The item "other manures" includes compound manures which were manufactured to some extent from superposphates and other manures bought from makers, whose returns are also included in the above table. The precise extent of this duplication is not known, but the value of the net output of basic slag and superphosphates, for use as such, is estimated to lie between £500 000 and £1 598 000; adding in the remaining manures the total output may be valued between £5 573 000 and £6 671 000, the latter figure being the total value in the above table. Only a small quantity was produced in Ireland.

2) *Net Exports in* 1907. — In the following statement particulars of imports and exports of phosphate of lime and rock phosphate and of bones for manure are not included, as these commodities largely form the

raw material for the manufactured manures. In the case of exports from Ireland this exclusion has not been possible as details are not given.

	Tons.	£
Total imports into United Kingdom	296 000	1 703 000
Deduct imports into Ireland from Great Britain and places abroad	95 000	518 000
Imports into Great Britain from abroad, less exports from Great Britain to Ireland	201 000	1 185 000
Total exports from United Kingdom	625 000	4 121 000
Deduct exports from Ireland to Great Britain and places abroad	69 000	291 000
Exports from Great Britain to places abroad, less imports into Great Britain from Ireland	556 000	3 830 000
Net exports from Great Britain to Ireland and abroad .	355 000	2 645 000

3) *Consumption in Great Briatain.* — Deducting the net exports from the home production, the value of the artificial fertilisers available for use on farms in 1907 wuld appear to lie between £2 900 000 and £3 900 000.

The classes of manures comprised in the home consumption would appear to be principally nitrate of soda, guano, and "unenumerated" manures imported, and superphosphates and "other manures" produced at home. The bulk of the basic slag and sulphate of ammonia and a portion of the superphosphates produced at home appear to be exported.

C. Summary.

Thus the total value of corn offals, oil cakes and other feeding stuffs, and of artificial fertilisers used in Great Britain in 1907, was approximately as follows :

	£
Corn Offals and Feeding Meals . . .	15 500 000
Oil Cakes and other Feeding Stuffs .	7 500 000
Artificial Fertilisers (say)	3 000 000
Total	26 000 000

Revised figures subsequently furnished by the Board of Trade would bring this total up to £28 400 000.

A certain proportion of the corn offals is purchased for pig feeding, poultry feeding, and other purposes by non-occupiers of agricultural land, while a part of the fertilisers goes to private gardens. On the other hand,

these figures of feeding stuffs take no account of the large quantities of maize and other imported corn which are purchased by farmers, and should certainly be included in the materials used in producing the "output." There is, however, no means of dividing the imports which go direct to the farms from those which go to the mills or are used in the towns, or by non-agriculturists in the rural districts. Among the "materials" used might be included the cattle, sheep, pigs and poultry sent in store condition from Ireland and fattened in Great Britain, which in 1908 would represent a value of nearly £7 000 000. Among other materials might be reckoned imported farm seeds and town manure, the latter consisting partly of straw returned to the farm.

III. — Fertilisers Industry.

Finally some further data and an insight into the British fertilisers industry may be gained from the last Annual Report of the Chief Government Inspector of the different chemical works in the United Kingdom.

As regards chemical manure works, no change of importance occurred in the methods of manufacture of superphosphates as regards the mixing of sulphuric acid with mineral phosphates and the prompt discharge of the still liquid mass into "dens" or receiving chambers. Mechanical devices for the removal of the manufactured superphosphate after this has become solidified by remaining for a sufficient length of time in the "den" and for the simultaneous rapid removal of excessive moisture from the still warm mass, were adopted more widely during the year. This is another instance where machinery may be used with advantage to perform an operation which otherwise is necessarily effected by manual labour under more or less trying conditions.

Statistics of importation of some of the materials in largest use in the trade show a marked increase in all cases : those for guano are particularly interesting : after a continued fall from 34 417 tons in 1908 to 7 000 in 1910, the figure for 1908 was very nearly reached again ; those for mineral phosphates and nitrate of soda show a steady improvement during the last two years, but are considerably short of the high imports for all three materials which characterised 1908.

The amounts (expressed in tons) imported during the last three years were :

	1911	1910	1909
Guano	34 124	7 000	20 321
Mineral phosphates	493 413	450 000	451 807
Nitrate of soda	128 487	120 600	90 207

The quantity of sulphate of ammonia recovered in the United Kingdom as a by-product from various industries is given as follows (tons):

	1911	1910	1909
Gasworks	168 783	167 820	164 276
Iron works	20 121	20 139	20 228
Shale works	60 765	59 113	57 048
Coke oven works	105 343	92 665	82 886
Producer-gas and carbonising works (bone and coal)	29 964	27 850	24 705
Total	384 976	367 587	349 143

The aggregate increase over 1910 is 17 389 tons. This increase is slightly less than the corresponding figure of 18 444 tons recorded for that year as compared with 1909, but the influence of unrest in the labour world which retarded advance in 1910 continued to have a similar influence throughout 1911, especially as regards the extension of recovery plant in connection with coke ovens.

The exports of sulphate of ammonia amounted to 292 000 tons, as compared with the estimated home consumption of 85 500 tons. During the previous year the quantity exported was 284 000 tons.

1511 - Production and Use of Fertilisers in the Commonwealth of Australia.

1. KNIBBS, G. H.: (Commonwealth Statistician). Agricultural Production, Fertilisers. — *Official Year Book of the Commonwealth of Australia*, No. 5, 1912, Section VIII, § 18, pp 406-410 Melbourne
2. ID.: Wheat, Imports and Exports of Wheat and Flour, Exports of Wheat and Flour. — *Ib.*, § 4; 5., (III), pp. 370-371.
3. ID. — *Jb.*, *passim*.
4. KOENIG, J.: Die menschlichen Nahrungs- und Genussmittel, IV. Aufl., *passim*.

A sure sign of the agricultural progress of Australia, is the development in the use of fertilisers as may be gathered from the authoritative statistics, as complete as possible, for the period 1901-1911 published by the Commonwealth Bureau of Census and Statistics.

General.

In the early days of settlement and cultivation in the Commonwealth of Australia, scientific cultivation was in a much less developed state than it is to-day. The early farmers were neither under the necessity, nor were they as a rule aware of the need, of supplying the constituents to the soil demanded by each class of crop. The widely divergent character of the soils in the Commonwealth, their degeneration by repeated cropping, the limitations of climatic conditions, the difficulties of following any desired

order of rotation of crops, all rendered it necessary to give attention to artificial manuring. The introduction of the modern seed-drill, acting also as fertiliser distributor, has greatly facilitated the use of artificial manures, and much land formerly regarded as useless for cultivation has now been made available. There is reason to believe that this feature will be even more strikingly characteristic of the future.

Fertilisers Act.

In order to protect the interests of users of artificial manures legislation has been passed in each of the States, regulating the sale and preventing the adulteration of fertilisers. The following is a list of such Acts in force :

New South Wales	—	Fertilisers Act of 1904.
Victoria	—	Artificial Manures Acts of 1904 and 1910
Queensland	—	Fertilisers Act of 1905
South Australia	—	Fertilisers Act of 1900; amended 1903
Western Australia	—	Fertilisers and Feeding Stuffs Act of 1904; amended 1905
Tasmania	—	Manures Adulteration Acts of 1893 and 1898.

As regards their main features these measures are practically identical. The words " fertiliser " and " manure " as used in these Acts, mean any substance containing nitrogen, phosphoric acid, or potash, manufactured, produced, or prepared in any manner for the purpose of fertilising the soil or supplying nutriment to plants, but do not include farmyard or stable manure or similar articles in their natural or unmanufactured state. The Acts provide that every vendor of fertilisers must, within a stated period, forward to the Secretary of Agriculture, or corresponding officer, samples of the fertilisers on sale by him, together with the distinctive name or brands by which they are known, and the price at which he intends to sell during the year. On every bag, package, or bundle of fertiliser sold, or exposed for sale, he must attach a printed label shewing thereon :

1) the number of net pounds of fertiliser in such bag or parcel;
2) the figure or trade mark attached to the fertiliser and intended to identify it;
3) the proportion per cent. of nitrogen, phosphoric acid and potash contained therein.

In addition to the above the vendor must furnish every purchaser with an invoice certificate, signed by himself or his agent, stating his full name and place of business and the quality of the fertiliser sold.

Any officer or analyst appointed under the Acts may enter any manufactory, warehouse, store, vessel, wharf, railway station, conveyance, or other place where fertiliser is manufactured, stored, exposed for sale, or in course of delivery or transit, and demand and take samples of such fertiliser. Every sample so taken must be divided by such officer into three parts, and each marked, sealed, and fastened by him in the presence of the person in charge, and disposed of as follows :

1) one part to be taken by person in charge ;
2) one part to be used for analysis ;
3) one part to be retained by the officer for future comparison.

Every buyer of fertiliser is entitled to submit a sample to the analyst appointed under the Act, and receive a certificate of its analysis. If the analysis prove it to be under what it is represented to be, the vendor must pay the cost of analysis.

Imports.

The local production of artificial manures falls short of the existing demand, and large quantities are consequently imported.

The importation of fertilisers has increased over 250 per cent. during the ten years of Federation. The chief items, both as regards quantity and value, are those relating to phosphates, a fertiliser apparently very suitable for the growing of cereals in Australian soils. The greater quantity of the manufactured superphosphates is obtained from the United Kingdom, whence came over 70 per cent. of the total imported during 1910, while Japan contributed about 17.5 per cent., and Germany nearly 6 per cent., the balance, representing 6.5 per cent., being imported from Sweden, Belgium, and the Netherlands. Ocean Island, with about 78 per cent., is the principal contributor of rock phosphates, the balance being obtained from Christmas Island. Guano is imported chiefly from Ocean Island, one of the South Sea group, and in lesser quantities from Malden Island, while India has practically a monopoly of the bone-dust trade with the Commonwealth.

The increasing demand for artificial manures is shewn in Table I. It will be noticed that the quantity of rock phosphates imported during the last three years has shewn a marked increase over previous years. This was particularly large during 1910, when an increase of over 100 per cent. is shown over the quantity imported in the previous year. The figures for the manufactured superphosphates show an increase of about 50 per cent. during the year.

TABLE I.

Commonwealth Imports of Fertilisers, 1906 to 1910.

Fertiliser	1906	1907	1908	1909	1910
Bone meal . . Cwt.	80 625	93 798	74 657	71 959	12 740
» £	20 094	24 103	18 988	17 632	3 294
Guano Cwt.	818 580	606 630	696 660	468 213	788 304
» £	103 953	75 130	84 961	56 723	89 961
Superphosphates. Cwt.	1 153 249	780 464	610 596	757 515	1 196 619
» £	170 514	133 352	94 203	105 229	174 751
Rock Phosphates. Cwt	547 079	769 630	267 665	1 006 030	2 112 127
» » £	70 782	103 609	183 817	143 246	294 212
Other Cwt.	84 979	227 689	197 240	151 241	377 327
» £	24 659	52 975	60 676	38 007	107 573
Total Cwt	2 684 512	2 478 211	846 318	2 454 960	4 487 111
£	390 002	389 169	441 745	360 837	669 791

Imports.

Table II shews the exports of artificial manures for the years 1906 to 1910. Practically the whole of the fertiliser is manufactured locally, and is shipped mainly to New Zealand and the Pacific Islands:

TABLE II.

Commonwealth Exports of Fertilisers 1906 to 1910.

Fertiliser	1906	1907	1908	1909	1910
Bone meal . . Cwt	57 845	59 878	65 491	62 637	80 602
» £	14 217	16 001	17 069	16 571	19 066
Guano Cwt.	6 000	5 000	—	—	2 812
» £	1 050	875	—	—	490
Superphosphates. Cwt.	110 530	194 943	250 236	235 939	260 261
» £	22 110	41 041	47 418	44 041	51 051
Rock Phosphates Cwt.	4 000	5 028	5 077	3 320	11 190
» » £	782	1 062	1 145	658	1 819
Soda nitrate . Cwt.	—	1 980	429	3 579	6 215
» £	—	1 168	222	2 075	2 844
Ammonia Sulphate. Cwt.	—	—	70 258	69 894	69 015
» » £	—	—	45 915	42 766	43 081
Other Cwt	109 849	148 816	120 524	177 189	229 841
» £	34 571	50 813	28 565	33 880	48 989
Total Cwt.	288 224	415 645	512 015	552 558	659 936
£	72 730	110 960	140 334	139 991	167 340

Statistics of Use of Fertilisers.

The statistics available in connection with the use of manures in the Commonwealth are those of New South Wales, Victoria, South Australia, and Western Australia. Particulars concerning the first-mentioned State are given in Table III.

TABLE III.

Fertilisers used in New South Wales 1907-1908 *to* 1910-1911.

Season	Total area of crops	Area manured		Manure used	
		Aggregate	Percentage to total area of crop	Natural (stable-yard etc.)	Artificial
	acres	acres	%	loads	tons
1907–1908	2 572 873	423 678	16.47	144 021	13 356
1908–1909	2 717 085	509 262	18.74	216 078	15 545
1909–1910	3 180 561	826 197	25.98	189 008	21 659
1910–1911	3 386 017	1 030 554	30.43	186 204	25 017

Particulars for Victoria for the past ten seasons are given in Table IV.

TABLE IV.

Fertilisers used in Victoria, 1901-2 *to* 1910-11.

Season	Total area of crops	Farmers using manure	Area manured		Manure used	
			Aggregate	Percentage to total area of crop	Natural (stable-yard etc.)	Artificial
	acres		acres	%	tons	tons
1901–02	2 965 681	11 439	556 777	18.77	153 611	23 535
1902–03	3 246 568	18 537	1 099 686	33.87	206 676	36 630
1903–04	3 389 069	19 921	1 205 443	35.57	207 817	41 639
1904–05	3 321 785	20 167	1 521 946	45.82	190 903	45 940
1905–06	3 219 962	21 586	1 791 537	55.64	210 507	54 674
1906–07	3 303 586	23 072	1 985 148	60.09	205 906	60 871
1907–08	3 232 523	23 733	2 018 079	62.43	232 394	62 337
1908–09	3 461 761	24 437	2 053 987	59.33	235 492	64 715
1909–10	3 658 535	26 680	2 407 331	65.80	197 446	77 579
1910–11	3 952 070	27 845	2 714 858	68.69	203 884	86 316

The figures relating to the use of fertilisers in South Australia, for the only years for which they are available, are shown in Table V.

TABLE V. — *Fertilisers used in South Australia* 1907-8 *to* 1910-11.

Season	Total area of crops.	Area manured		Manure used	
		Aggregate	Percentage to total area of crop.	Natural (stable-yard etc.)	Artificial
	acres	acres	%	loads	tons.
1907–08	2 265 017	1 573 861	69.49	124 092	60 008
1908–09	2 321 812	1 712 394	73.75	120 648	64 842
1909–10	2 530 301	2 031 832	80.30	133 935	76 413
1910–11	2 746 334	2 235 578	81.40	129 918	81 899

Corresponding particulars relative to Western Australia for the seasons 1904-5 to 1910-11 are given in Table VI, and furnish interesting evidence of the rapid extension of the use of manures in that State :

TABLE VI. — *Fertilisers used in Western Australia*, 1904-5 to 1910-11.

Season	Total area of crops	Area manured		Manure used	
		Aggregate	Percentage to total area of crop	Natural (stable-yard, etc.)	Artificial
	acres	acres	%	loads	tons.
1904–05	327 391	205 923	63.90	72 523	10 787
1905–06	364 704	257 469	70.60	83 033	12 676
1906–07	460 825	340 401	73.87	81 653	16 127
1907–08	493 937	391 146	79.21	73 809	17 273
1908–09	585 339	493 545	84.32	61 834	21 358
1909–10	722 086	608 870	84.32	67 263	24 654
1910–11	855 024	773 561	90.47	62 229	33 194

A marked increase in the proportion of cropped land treated with manure is in evidence in all of the States for which returns are available. Thus in New South Wales the area of manured land represented in 1907-8

only 16.5 per cent. of the area under crop, as against 30.5 per cent. in 1910-11. Similarly in Victoria the percentage increased from 18.75 per cent. in 1901-2 to over 68.5 per cent. in 1910-11, in South Australia from 69.5 per cent. in 1907-8 to 81.5 per cent. in 1910-11, and in Western Australia from 64 per cent. in 1904-5 to 90.5 per cent. in 1910-11.

Local Production of Fertilisers.

Statistics relative to the local production of fertilisers are necessarily very incomplete, and detailed returns for fertiliser factories other than bone mills are not available. The number of firms engaged in the manufacture of artificial manures in the Commonwealth during the year 1910 was 78, made up as follows : New South Wales, 20 ; Victoria, 24 ; Queensland, 13: South Australia, 12 ; Western Australia, 6 ; and Tasmania, 3. If, however, approximately complete returns of the quantities of fertilisers used in the various States could be given, a comparison with the importations would give valuable information ; but, as already mentioned, such particulars are only available for four of the States, and even then do not furnish the whole of the information necessary.

Benefits derived from the Use of Fertilisers.

There can be little doubt that the increased and increasing use throughout the Commonwealth of Australia of fertilisers, natural and artificial, combined with the greater attention being devoted to fallowing and to the combination of sheep farming with agriculture, is having the effect of improving the prospects of the Australian agricultural production.

By way of illustration an estimation may be made of the losses of phosphoric acid from the soil involved in the exports from the Commonwealth of wheat, which are second only to those of wool in importance. From this the necessity for returning this ingredient in some form may be inferred. According to an estimate furnished by the chemist to the New South Wales Department of Agriculture, F. B. Guthrie, the proportions of milled product from a bushel (60 lbs.) of wheat are, approximately, 42 lbs. of flour, 9 lbs. of bran, and 9 lbs. of pollard, while the percentage of phosphoric acid contained in these products is reported as follows :

Flour	0.32 per cent.or		0.13 lbs. per bushel	
Bran	3.00	,, ,,	0.27	,, ,,
Pollard	0.90	,, ,,	0.08	,, ,,

The total amount of phosphoric acid contained in a bushel of wheat is, therefore, 0.48 lb., of which 0.13 lb. in the flour and 0.35 lb. in the offal. During the past 10 years the net exports from the Commonwealth of wheat

and its milled products have amounted to 232 851 144 bushels of wheat, 1 023 401 tons of flour, and 4 421 818 bushels of bran, pollard, and sharps. On the basis of the figures quoted above, this export would contain no less than 120 000 000 lbs. of phosphoric acid, the value of which as a fertiliser would be about £750 000.

Similarly, other staple products exported impose their respective losses upon the soil of the Commonwealth and the increased use of fertilisers furnishes evidence that producers are alive to the necessity for making good the deficiency so arising.

AGRICULTURAL BOTANY
CHEMISTRY AND PHYSIOLOGY OF PLANTS

1512 - **Grafting and Variations of a Chemical Nature.**

GRIFFON, ED. Greffage et variations d'ordre chimique. — *Bulletin de la Société botanique de France*, Vol. LIX (Fourth Series, Vol. XII), Nos. 4-5, pp. 332-341. Paris, 1912.

Since 1905, the writer has been prosecuting researches on variation in grafting, with special reference to the morphological side of the question. Recently, he has again returned to the subject, much studied some time ago, of the transmission of a certain type of variegation by means of grafting. Finally, he has, during the last few years, turned his attention also to variations of a chemical nature (modifications of colour, or of taste).

The writer concludes from his first series of experiments, that except in cases of anomalous shoots from the callus, the specific independence of scion and stock is perfectly established. Some variegations are transmitted by grafting, others are not; while other types of coloration have no effect upon the associated plant.

Practical men have always admitted that grafting on different stocks can modify the taste of fruits, but not to the point of changing the varieties. Various examples are cited. The vine has been especially studied, with results that are not always easy of interpretation.

The writer, after studying other grafts, turned his attention to those between different species of Solanaceae from the point of view of the passage of specific alkaloids from the graft to the stock , and reciprocally, both in the case of ordinary and mixed grafts (those where shoots are allowed to develop from the stock).

M. Laurent had found atropin in the roots of a tomato stock on which deadly nightshade was grafted, while there was none of this alkaloid present in tomato grafted on deadly nightshade. With mixed grafts, atropin passes from the deadly nightshade graft to the tomato stock, while in the reverse graft there is no such migration of the alkaloid.

The writer, however, in studying the ordinary graft of deadly nightshade on potato, found no trace of atropin in the tubers of the latter plant. In some mixed grafts of deadly nightshade on tomato the fruits of the latter contained atropin ; in the opposite mixed graft, the fruits of the tomato, but not the stem or leaves, contained atropin. Finally, the writer sowed

the seed of tomatoes resulting from a mixed graft with deadly nightshade and containing a little atropin. The plants obtained were self-fertilised and the fruits analysed ; they proved to be free from atropin.

The writer thus concludes that atropin can pass the point of union of the graft and find its way into the fruits on shoots from the stock, without these fruits producing the compound themselves. On the other hand, the seed has not been specificially altered ; no asexual hybridization has taken place.

In mixed grafts of tobacco on potato, M. Javillier has found that there is no nicotine present in the aerial parts, or in the roots, stolons or tubers.

In the case of grafts of varieties of tobacco differing from one another in nicotine content, sometimes a modification in the proportion of this alkaloid has been observed. Nevertheless, equal and even larger differences have occurred during the experiments of the writer where one variety has been grafted upon itself. Thus, changes in the proportion of alkaloids cannot be attributed to asexual hybridization, but are simply the result of variations in nutrition due to grafting.

The writer remarks in conclusion that " while we can say with M. Guignard, that in grafting certain substances remain localised in one or other of the subjects joined (as with hydrocyanic glucosides), and can agree with M. Javillier, that other compounds pass from the one to the other; still without it being possible, as yet, to lay down any general rule, it is, however, easy to see from an investigation of the above-mentioned facts, that M. Guignard was right in saying that, in the case of the artificial symbiosis brought about by grafting, each of the united portions preserves its own chemical activity and its autonomy intact. The transport of a substance from one plant to another is not quite the same thing as the production of this substance by the latter ; but on the other hand it frequently happens, and especially in the case of ordinary grafts, that such a passage does not take place. Lastly, when quantitative variations are observed, these can often be explained as the result of changes in nutrition due to the operation of grafting."

1513 - **Early Budding produced by Radium Treatment.**

MOLISCH, H. Ueber das Treiben von Pflanzen mittels Radium. (Mitt. aus dem Institut für Radiumforschung, XVI ; Aus dem pflanzenphys. Institut der K. K. Universität Wien, zw. F., 28). — *Sitzungsberichte der Kais. Akademie der Wissenschaften, Math - Naturwiss. Kl.*, Vol. CXXI, Parts I-III, Div. I., pp. 121-139, plates I-II. Wien, 1912.

As a sequel to enquiries into the way in which plants behave under radium and its emanations, the author wished to ascertain whether radio-activity, like other physical and chemical agents, would lead to a curtailment of the period of repose and consequently to early budding.

It is indeed found that the radiations from radium preparations have the noteworthy property of interrupting at a given time the repose of the

winter buds of different woody plants, inducing their early development. For instance, the terminal buds of *Syringa vulgaris* submitted for two days to the action of powerful radium preparations at the end of November or in December, shortly afterwards developed in the hot-house; while those which had not undergone the treatment did not grow until much later. The treatment must not last too short a time, in which case it has no effect; nor yet for too long, as it will then exert an injurious and finally fatal action. The effects of radio-activity are not sensible either at the beginning or at the end of the period of rest, and the behaviour in this point is analogous to that with treatment by ether or in warm baths.

Still more perceptible in its action than the preparation of radium is the emanation from the substance itself, owing to its more widespread and uniform action. At the stage indicated, moreover, the emanation acts with equal efficacy on *Aesculus Hippocastanum, Liriodendron tulipifera, Staphylea pinnata* and to a certain extent also on *Acer platanoides.* On the other hand no positive result was observed on *Gingko biloba, Platanus* sp. and *Fagus silvatica,* which two latter are also tardy in reaction to ether and the warm bath.

Although the high cost of radium preparations is an obstacle at present to the practical application of this discovery, the latter is nevertheless worthy of note, among other things because, as the author proposes to show, the action of powerful preparations of radium on plants in growth is different from that exerted during the resting period.

SELECTION. 1514 – **The Cornell Experiments in Breeding Timothy.**

WEBBER, HERBERT J. in *American Breeders Magazine,* Vol III, No. 2, pp. 85-99, 5 plates. Washington, 1912. (*Paper No* 25, *Department of Plant-Breeding, Cornell University,* Ithaca, New York).

Hay is among the three largest agricultural crops of the United States in total value of production. In 1910, according to the statements issued by the United States Department of Agriculture, there were grown in the United States 45 691 000 acres of hay which yielded a crop having a farm valuation of $ 747 769 000. In the writer's opinion, at least one third of the hay crop ($ 249 000 000) of the country is timothy. Notwithstanding its great importance, there are no varieties of timothy known. So far as the writer is informed only one series of experiments in the breeding of timothy has been carried to a successful conclusion. Between 1895 and 1899, Dr. A. D. Hopkins, then of the West Virginia Experiment Station, made selections of good timothy plants observed in nature and found that they could be bred into distinct varieties (*Proc. Soc. Pro. Agr. Science,* 1895, pp. 29-33). These varieties were later placed with the U. S. Department of Agriculture for trial, but have not been introduced into general cultivation.

The Cornell experiments in breeding timothy were started in 1903 and were carried out by Prof. T. F. Hunt, Prof. Gilmore, Mr. Fraser, and further (from 1907) by the writer, assisted by Dr. C. F. Clark. In order to secure various forms, seed was obtained from 231 different places, 21 States of the North American Union, Canada, Japan and 9 European countries being represented. The seeds were germinated in sterilized soil and the little plants grown for a time in the greenhouse. They were later transplanted into field plats, 42 plants being grown from each lot of seed. In the field the plants were placed in rows 30 in. apart each way in order to facilitate the cultivation and allow the full development of each individual. No final conclusions can be drawn regarding the comparative value of the individuals until they have been under observation for 4 or 5 years.

In 1907 there were about 20 000 plants which had reached sufficient age to allow of their mature characters showing plainly and of the choosing of plants of different types.

The variations in different plants of timothy cannot be observed plainly when the plants are grown under field conditions. It is necessary to have the individual plants grown alone with considerable space around them in order to study the variations. By this means plants were obtained presenting a large range of variation in height (from 18 to 55 in.); in the diameter of the plant (from small and little stooling to abundantly stooling and forming clumps from 1 to 1½ ft. in diameter with hundreds of culms); in yield (from 0.16 oz. to 21.06 oz. of dried hay per plant); in the diameters of the stems and in their ability to stand erect; in length and width of leaves, which however show little variation in number (3 to 7, most regularly 5); in size and shape of the heads; in density, position of leaves, color, time of ripening, resistance to disease — the resistance to rust (*Puccinia graminis*) being particularly valuable — etc. In season of maturity a variation of from two to three weeks is occasionally found.

The selection of the individuals showing valuable characters and the testing in order to study whether they would reproduce these characters or whether they were hybrids or accidental and unstable variations has formed the basis of the writer's experimental work

"Clons", or vegetatively propagated varieties, regularly transmitted all their characters; plants from inbred seed transmitted a very large number of their characters in marked degree. Hence the selected varieties represent distinctly different types which transmit their characters. Particularly the character of light or heavy yield is strkingly transmitted.

To test the different selected sorts under ordinary conditions open-fertilized seed was sown in test-plats in comparison with similar check plats of ordinary timothy. In 1910 all of the 17 new sorts gave an average yield of 7451 lbs. per acre, while all of the check plats gave an average

yield of 6600 lbs. per acre. In 1911, which was a less favorable season for timothy, the average yield of all the 17 new sorts was 7153 lbs. per acre, while the check plats gave an average yield of only 4091 lbs. per acre.

Furthermore it is stated that the quality of hay produced by the new sorts, owing to the retention of a fresh green quality and leafiness, would be superior to that of ordinary timothy.

1515 – Selection as a Factor in increased German Production during the last three Decades.

LEHN, D. Die Ursachen der in dem landwirtschaftlichen Pflanzenbau während der letzten drei Jahrzehnte erzielten Ertragssteigerung. — *Illustrierte Landwirtschaftliche Zeitung*, Year 32, No. 69, pp. 627-628 ; No. 70, pp. 636-638. Berlin, August 28 & 31, 1912.

The study of the factors which have brought about the increase of agricultural production in Germany during the last three decades is particularly instructive, not only from the historical, but also from the present-day point of view, inasmuch as it may foster the further progress of favourable factors. This increase in production may be ascertained both from an examination of the accounts of some special farms and from the returns of agricultural statistics. Confining the enquiry to these latter we find the following :

Average yield per acre.

Decade	Wheat	Rye	Barley	Oats	Sugar beets		Potatoes	Meadow Hay
—	bush. of 60 lbs.	bush. of 54 lbs.	bush. of 55 lbs.	bush. of 42 lbs.	roots tons	sugar cwt.	— tons	— cwt.
1897-1888 .	19.92	16.12	21.10	24.13	11.9	25.1	3.2	23.6
1889-1898 .	21.84	18.46	24.13	25.90	12.1	30.3	3.7	25.2
1899-1908 .	28.70	25.89	30.32	37.84	11.7	35.2	5.3	25.5

The factors calling forth this increase of the productive capacity of German agriculture are in brief : selective improvement of the cultivated plants, manuring, reorganisation of the farm, and improvement of the soil. The selection factor is, so to speak, inherent in the plants themselves, while the others depend on external influences. Therefore in the increase of the productive capacity of cultivated plants selection represents the pre-determined and principal factor.

From the particulars given by Schindler (1909) the wide prevalence of the following selected varieties is evident :

Distribution of the Varieties of Cultivated Plants in Germany.

	North Germany	South Germany	All Germany
1. Wheat:			
Squarehead	63.7	36.6	59.0
Local varieties	11.9	51.5	18.6
2. Rye:			
Petkuser	62.9	30.3	57.2
Probsteier	27.5	12.0	24.9
Schlanstedter	19.7	18.7	19.6
Zeeländer	10.7	6.0	9.9
Local varieties	3.1	38.7	9.0
3. Spring Barley:			
Hanna	33.9	15.3	30.8
Chevalier	31.0	26.0	30.2
Local varieties	24.7	41.0	27.4
4. Oats:			
Anderbecker	29.6	20.0	28.0
Probsteier	22.5	8.0	20.1
Beseler	7.9	20.3	10.0
Local varieties	7.3	14.0	8.5
5. Potatoes:			
Magnum Bonum	56.9	59.0	57.2
Maercker	38.1	31.0	37.0
Daber	14.1	—	12.0
Blaue Riesen	8.1	19.7	10.0
Silesia	11.0	—	9.2
Prof. Wohltmann	10.5	5.7	9.0
Imperator	9.7	5.7	8.8

The part played by the selected varieties in the increase of production is still more conspicuously evident from the data of experiments supplied by the German Agricultural Society. The average production of the varieties of wheat under trial from 1894 to 1900 was 2105 lbs. per acre, with a downward deviation for the local variety Frankensteiner of 145 lbs. and an upward deviation of 125 lbs. for the selected variety Mold's Red Prolific; while between 1896 and 1899 Squarehead gave an average of 2936 lbs. Similarly for rye from 1889 to 1894 the average of the different varieties experimented was 1835 lbs. per acre; while for the period 1905 to 1907 the three selected varieties Heines Zeeländer, Petkuser and Altpaleschkener yielded an average production of 3070 lbs. per acre, the following deviations taking place likewise:

1889-94 . . .	Petkuser + 186lbs.	on the general average
» . . .	Sagniker — 146lbs.	
1900-02 . . .	Petkuser + 229lbs	

In the case of oats the figures are not for the same periods : it appears that in the period 1889-1893 the average production was 2277 lbs. per acre ; in 1901-1904, 2670 lbs. *i. e.* an increase of 393 lbs or 17.2 %. In respect of sugar beets the following returns of tests at Halle, given by Maercker, are particularly instructive :

	Percentage of sugar		Produce per acre	
	in the beets	in the juice	roots — tons	juice — cwt.
1882-85	13.7	15.0	16.7	44.9
1885-91	15.3	17.1	15.4	46.6

These particulars confirm the well known diminution of total production simultaneously with the increase of grade and sugar product ; this latter is also due to the improved use of fertilisers and the more efficacious tillage of the soil. The favourable effect of selection on potatoes stands out more clearly, taking the following data based on cultivation experiments and on the enquiries by the Union of German Distillers ; they refer to typical farms all over Germany :

Variety	Area cultivated in percentage of total area	Yield per acre — tons cwt.	Excess over Daber — cwt.	Total crop — tons
		1888		
Daber	34.4	7 18	—	674
Champion	10.6	8 8	10 3/4	222
Seed.	9.8	8 15	16 1/2	212
Gelbfleischige Zwiebel .	7.1	8 8	10	148
Imperator	3.7	10 5	46 1/4	94
	65.6			1350
		1901		
Prof. Maercker. . . .	26.1	10 12	54	686
Daber..	13.0	7 18	—	255
Magnum Bonum . .	6.9	8 7	9 1/4	133
Imperator	6.2	10 5	46 1/4	157
Silesia	5.9	11 6	67 3/4	165
Prof. Wohltmann . .	3.4	10 10	51 3/4	88
Hannibal	3.0	8 12	13 1/4	64
Geheimrat Thiel . . .	1.4	10 13	55 1/4	37
	65.9			1585

This means to say that on the same area from 1888 to 1901 there was an increase of crop of 235 tons, equivalent to 17.4 %.

In conclusion, from these last figures it is possible, as regards potatoes in contrast to cereals, to calculate with sufficient approximation what is the part played by selection in increasing the unit product of potatoes in Germany. The official agricultural statistics for the periods 1884 to 1899 and 1899 to 1903 show an increased production of 82.5 %; but making allowance for the different bases on which the returns were prepared at the two epochs, this increase is reduced to 57.4 per cent. Then, collating the above percentage of 17.4 for which selection is accountable with that of 57.4 per cent. of total increase, it is found that selection has contributed to the increase of productivity of potatoes in Germany during late years to the extent of one:third to one fourth of the aggregate increase.

1516 - **Biological Considerations in Relation to Seed Testing.**

Biologische Gesichtspunkte für die Samenprüfung. — *Deutsche Landwirtschaftliche Presse*, Year XXXI, No. 78, pp. 901-902. Berlin, September 28, 1912.

The following is the summary of a paper read by Dr. Schaffnit at the meeting of naturalists in Münster in Westphalia.

From the seed tests carried out for years in the division of plant pathology of the « Kaiser Wilhelm » Agricultural Institute of Bromberg, on the basis mainly of biological considerations in reference to the previous season, it was found that the method of determining the germinating capacity of seeds hitherto commonly adopted does not give an exact idea of the productivity of the seed itself. The usual test of germinating capacity determines the germinating power of a seed placed under the best possible conditions, not under field conditions. There the seed which sprouts must use up a certain quantity of energy to emerge from the surface of the soil (usually from a depth of 3 to 8 cm. according to the quality of the seed). The lecturer applies the term of " shooting power " (" Triebkraft ") to this capacity of emerging from the soil, in contrast to " germinating energy " (" Keimenergie "), which was hitherto used to express both the rapidity with which the seed germinates (after a given number of days) and its appearance above the ground. Consequently Dr. Schaffnit distinguishes " germinating capacity " (" Keimfähigkeit "), " rapidity of germination " (" Keimschnelligkeit ") and " shooting power " (" Triebkraft ").

To take account of the natural conditions in which the seed grows and make them the basis of the laboratory test likewise, the lecturer does not bring about the germination of the seeds in terracotta vessels or in plates on filter paper or sand, but places them in mineral substances at the depth at which they find themselves under natural conditions, 3 cm. (1 ¼ in) for instance for cereals. Generally the examination of numerous

specimens on this method yielded for the shooting power figures noticeably lower than those expressing the germinating capacity. Specimens having 100 % germinating capacity often yielded 60 % or less of shooting power.

These experiments explain the bad result, after sowing in the field, of seeds which hitherto in the laboratory test had been found faultless; a point of which in many cases it had hitherto not been possible to furnish any explanation. It was established that the general cause of this difference of behaviour lies in conditions of physiological weakness of the seed, incapable of germinating, and by means of suitable trials it was ascertained that these conditions were especially present in small seeds. The small seeds of one and the same species and one and the same kind have at their disposal a less quantity of vital energy and, according to the size and weight, a notably smaller quantity of reserve substances. Hence follows, as an important practical rule, the necessity of careful preparation and selection of the seeds on the basis of their size.

The question now arises of the behaviour of the seed which does not sprout, while it had been shown to be capable of germination by the ordinary means. The seeds do indeed in the majority of cases germinate, but they do not possess the power to emerge from the surface of the soil and they bend back in a spiral without reaching it. These conditions of physiological weakness may have various causes. From the observations of Hiltner, the influence of the attacks of *Fusarium* is known; to this must be added that of various other micro-organisms. As an essential cause there are also found a series of other factors, partly internal and arising from the constitution of the plant, and partly external and of different kinds; such is the state of early maturity in which the seed may have been gathered as happened in 1911 owing to the long period of drought. The same folding back of the young shoots was produced by their being attacked by chemical substances (over-concentrated or acting too long) such as those used for killing the spores of bunt (*Tilletia*) adhering to the grains of wheat (sulphate of copper, formaldehyde); or owing to excessive heating in the destruction of smut (*Ustilago*) of wheat and barley, when the limits of the critical temperature have not been strictly adhered to; or through exposure to low temperature of the seeds, which by swelling in water had been brought from the state of rest into a less stable condition. Finally, on the basis of the directions of Hiltner, the lecturer described a method of examining the seeds in the laboratory which allows fully for the natural conditions and represents exactly the capacity of growth in the field and value of the seed. To obtain uniform results in the tests of shooting power the following constant conditions of cultivation are necessary:

1. Regularity and uniformity of the medium in which sowing is effected.

2. Determined depth of sowing.

3. Constant quantity of water in the medium in which sowing takes place.

4. Constant temperature.

It was found that the best medium in which to effect sowing is coarse brick powder, freed from the fine dust by sifting. Each time before using it, it is heated for two hours in an autoclave at 150°. It is mixed with 20 per cent. of water and the Hiltner germinating boxes are filled with it up to the required distance from the upper mark, 3 cm., for instance, in the case of cereals, which as a rule are sown in rows at 3 cm. depth. Then 100 grains are sown per box and the latter filled with brick powder as far as the upper mark. Nine boxes are put in a zinc box with an area of about 75 sq. cm. (10 ½ sq. in.) and a height of about 7 cm. (2 ¾ in.) placed on bricks. Into the zinc box 1 to 1.5 litres (1 ¾ to 2 ½ pints) of water are poured, and then a square glass bell of 50 cm. (20 in.) side is put on top of the bricks so as to hang into the water. By covering the germination boxes with the bell, the moisture which the seeds have at their disposal for germinating and developing is caused to remain almost constant until the end. The temperature at which the germinating boxes must be kept is 15° C. (59° F.).

CEREAL AND PULSE CROPS.

1517 – **Cultural Experiments with Cereals at the Samarkand Experiment Station.**

BUSHNEFF, M. (Posievi Osimnekh i Yarovekh Khliebov, Propashnikh Rastenii i Dr.) — *Otceti o Sostoiania i Dielatelnosti Opetnekh Khlopkovekh v Turkestanie Zakaspiiskoi Oblasti v 1909 Godu* (Communications on the Condition and Work of the Cotton Experiment Stations in the Turkestan Districts and in the Transcaspian Region in the Year 1909), Part IV, pp. 42-46. St. Petersburg, 1912.

Winter Cereals. Experiments were carried out with the local type of wheat with the object of determining: 1) the influence of spring manuring on the crop; 2) the influence of the time of sowing.

1) The top dressing was given on March 2 when the wheat was tillering. The following are the results.

Superphosphates, 7 ¼ cwt. per acre yielded	12.0	cwt.	grain
	12.7	»	straw
Bone meal, 16 ¾ » » »	11.2	»	grain
Cotton residues, 24 » » »	11.2	»	»
Dried blood, 15 » » »	15.1	»	»
Control plot » »	10.4	»	»

The use of dried blood is thus recommended for the evident increase of yield and for its low price.

2) The seed was sown on September 1 and on October 5. The results given below are decidely in favour of early sowing.

The wheat sown on September 1 yielded 9½ cwt. of grain and 9½ cwt. of straw per acre; the degree of tillering was from 5 to 8; the ears were large, the grains well developed and the wheat was not damaged by locusts.

The wheat sown on October 5 was on the contrary much injured by locusts; it yielded 7¼ cwt. of grain and 8 cwt. of straw per acre; the degree of tillering was from 3 to 4, the ears were light and narrow with many poorly developed grains.

Maize. The three varieties Kutaiskaia, Bessarabskaia and Cinquantino were grown. Part of the seed was sown on April 15, without irrigation, in soil ploughed to a depth of 6 inches, and the rest was sown on May 15 with irrigation in soil ploughed to the same depth. The results are given in the following table:

		Yield grain cwt. per acre	Yield stalks cwt. per acre	Percentage, by weight, of grain in the ear
Kutai	sown on April 15	31.86	105.14	75 %
	» » May »	29.47	39.03	
Bessarabskaia	» » April »	15.13	47.79	79 %
	» » May »	9 56	13.54	
Cinquantino	» » April »	11.15	27 88	85 %
	» » May »	7.97	8.79	

1518 – Experiments in the Cultivation of Early Stand-up Vilmorin Hybrid Wheat in Italy.

ZAGO, F. Il frumento ibrido inallettabile alla prova. — *L'Italia Agricola*, *Year* XLIX, No. 18, pp. 425-431. Piacenza, September 30, 1912.

During the last cereal season, many experiments were made with stand-up hybrid (très hâtif inversable), especially in the districts of Cremona and Piacenza. The results of these experiments were eagerly awaited, in order to see whether the opinions held concerning this wheat during the four first experimental years (1907-1911) would be confirmed, or modified.

The following are some of the results obtained in different zones:

In the province of Cremona, in many experiment fields of from 1¼ to 11 acres, the crops varied from 28 ¾ to 60 bushels (1) per acre. The most usual yields were 38, 42 and 46 bushels on an average. The increase over ordinary varieties was 4½, 6, 10½ and sometimes 22 bushels.

In the province of Piacenza, about 200 acres were sown with the hybrid last year; the situations were different and included low plain, high plateau and average hilly land. Each lot was over 2½ acres in extent

(1) These figures are calculated at 60 lbs. to the bushel. (*Ed.*).

and sometimes the areas were 20 to 25 acres. All the crops gave high yields: minimum 33 bushels, maximum 45 to 52 bushels per acre. It was especially noted that the resistance to lodging was retained, for although of average height, the hybrid being quite upright, stood up above all the ordinary wheats, most of which were lodged.

In the district of Treviso, the qualities of the hybrid wheat were also reported: remarkable resistance to lodging and the capacity of standing very heavy manuring. Favourable results were obtained in the district of Brescia and in the Agricultural Colony at Romedello, in Polesine, the district of Padua, Sabine country and elsewhere. Thus, in general, the numerous experiments made in different districts gave entirely favourable results as regards the qualities of the Early Stand-up Vilmorin hybrid, which is distinguished by its power of resistance to lodging and its great productivity. It, however, requires very fertile land, such as ploughed-up, or soil which has been liberally manured and is perfectly drained, as this wheat is more susceptible than others to the effects of excessive damp.

The grain of this hybrid is ovoid in shape, of average size, resembling somewhat the Noé variety, and has a floury fracture.

These experiments, which were not made on the usual small plots, but over large areas in differently situated localities, have shown that this hybrid possesses the qualities required in a variety destined for intensive cultivation, and during five years of experiment, it has fully justified the favour in which it is held by agriculturists. It is therefore worth while extending the experiments and choosing for this purpose the most fertile soils.

1519 – **A Preliminary Report on Rice Growing in the Sacramento Valley.**

CHAMBLISS, CHARLES E.: *U. S. Department of Agriculture, Bureau of Plant Industry, Circular* No. 97, 10 pp. + 2 plates. Washington, August 16, 1912.

In the spring of 1909 the Office of Grain Investigations of the Bureau of Plant Industry of the U. S. Department of Agriculture inaugurated tests to determine the adaptability of rice to the climate and soil of the Sacramento Valley, California. These tests were made on the black adobe soil lying on the east side of Butte Creek, approximately 9 miles west of Biggs. This soil is of a close, compact structure. When wet it has an exceedingly tenacious and putty-like consistency. During the dry season it breaks at the surface into blocks with deep fissures between them. These blocks upon long exposure are divided and subdivided by smaller fissures until the surface may become a loose, shallow mass of small pieces of the size of peas. In this condition the soil absorbs water readily, which is given up slowly under evaporation. The subsoil, which lies at a depth of approximately 3 feet, is very impervious, though water penetrated it to a depth of 6 in. before the plats were drained. The surface of the plats

was nearly level, with just enough slope for good drainage into the narrow sloughs, which are features of the topography of this area of black adobe that may be used for conveying water for both drainage and irrigation.

Grain had been grown exclusively upon this land, though it was not under cultivation during the year preceding the tests. The land was plowed in the autumn to get the clods broken down by the winter rains.

The seed of each variety was planted with a drill to the depth of 1½ to 2 in. at the rate of 80 lbs. per acre. On account of a lack of moisture in the soil, it became necessary to apply water to germinate the seed. This irrigation is not likely to be required when the planting is done immediately after the late spring rains or before the end of the rainy season. It would not be advisable to plant early except on well-drained land that had been plowed in the autumn.

In the first irrigation the water was retained long enough to wet the surface of the soil thoroughly. The second application of water was made when the plants were approximately 3 in. high, which was sooner than would have been necessary if the soil had not become too compact on the surface when the plats were drained. From this period water was applied every 7 to 10 days to keep the soil moist. After the plants had tillered well the land was submerged to a depth of 3 to 5 inches. This submergence was continuous until the grain reached the hard-dough stage. At this stage of maturity the plats were drained for harvest. All varieties were allowed at least 10 days in the shock before they were thrashed.

From the date of planting until October 1 there was less than 1 in. of rain. During the same period the average daily range of temperature varied from 29° F. in May to 38° in August, with the greatest range occurring in July, August, and September.

In this valley these rices require a longer time to mature and they produce smaller plants than when grown on the plains of the Gulf coast, but they exhibit a greater capacity for tillering, with resultant larger yields.

The short-grain rices appear to be better suited to the climate of the Sacramento Valley than the long-grain varieties. They ripen more uniformly, though slowly, tend to shatter less, and produce larger yields. There is less sun-cracking of the grain in these varieties after ripening than in the long-grain rices, which will result, of course, in a larger percentage of head rice when milled.

The number of days for maturing the crop may be greatly lessened by stimulating the growth at the time the plants begin to "boot" by increasing the depth of water, with a gradual lowering of it during this period, and by giving another impetus to growth by suddenly increasing the depth of water just as the heads appear. This last depth of water should be maintained until the heads begin to turn down, when the land

Results of variety tests of rices grown upon one-tenth acre plats on black adobe soil in the Sacramento Valley of California in* 1910.

G. I. No.	Date planted.	Date land was submerged.	Date of maturity.	Days to maturity.	Height of plant, including head.	Length of heads.	Heads per plant.	Yield per acre **
					inches	inches		bushels
1533	Apr. 12	June 25	Oct. 22	193	38	7.0	6–12	71.5
1561	» 13	»	»	192	36	7.5	7–21	154.0
1562	»	»	Oct. 1	171	40	7.5	7–10	131.3
1563	»	»	Sept. 29	165	40	7.0	6–14	122.4
1582	»	»	» 2	142	31	7.0	8–22	42.8
1583	»	»	»	142	33	7.0	8–15	47.1
1585	»	»	»	142	31	6.5	8–22	58.0
1597	Apr. 12	»	Sept. 7	148	28	6.5	5–14	71.3
1599	» 13	»	» 2	142	33	7.0	8–15	23.1
1600	»	»	» 30	170	38	7.0	6–11	94.6
1602	»	»	» 25	165	36	7.0	9–20	77.7
1642	Apr. 12	»	Oct. 22	193	29	7.0	10–27	124.0
1643	»	»	»	193	38	7.5	6–12	63.3

*) These rices, on account of the quality of their grain, were selected for planting in 1910 from 300 varieties which were grown in the Sacramento Valley in 1909 on plats consisting of only 4 rows, a rod each in length and 7 inches apart. The yields from the rices in 1909 were relatively much higher than in 1910, when the plantings were made on a larger scale. Estimated upon the actual yield from plats one-half acre in size, the Wataribune (G. I. No. 1561) and Shinriki (G. I. No. 1642) varieties in 1910 yielded 113.7 and 137.2 bu. per acre, respectively.

**) Estimated upon the actual yields from one-tenth acre plats.

should be drained for harvest. A shorter season and earlier planting seem desirable in order that the crop may escape the effect of the increasing humidity in September and October, which appears to lengthen the period of ripening.

The Honduras (G. I. No. 1643) and Shinriki (G. I. No. 1642) varieties are the leading commercial rices of the United States. In this test these varieties have exceeded the maximum yields produced on experimental plats in Louisiana and Texas. Of the two rices, the Shinriki, which is a small-grain variety, is better adapted to the Sacramento Valley. The

Wataribune (G. I. No. 1561), the Oiran (G. I. No. 1562), and the Shinriki (G. I. No. 1642) varieties produce good yields, but on account of the long period which they require for maturity they may never become the leading rices of the Sacramento Valley, because the late planting of them might result in the loss of a crop. For this reason early-maturing varieties of good quality, though producing less per acre, might be more remunerative. The other varieties included in the Table are introductions from foreign countries.

Suggestions as to methods of culture are given and the following conclusions are drawn :

" The results from a two-year test of 300 varieties of rices on black adobe soil near Biggs, Cal., indicate the possibility of rice culture in the Sacramento Valley. The successful introduction of this crop is dependent upon an abundant supply of water, which must always be available during the growing season. The soil area adapted to rice in this valley is sufficiently large to produce many times the 55 000 000 lbs. of cleaned rice which are consumed each year on the Pacific coast. How much of this area has sufficient available water for proper irrigation is uncertain, though for a good portion of it there is apparently an abundant supply. Increase in the rice acreage should therefore be made with care. "

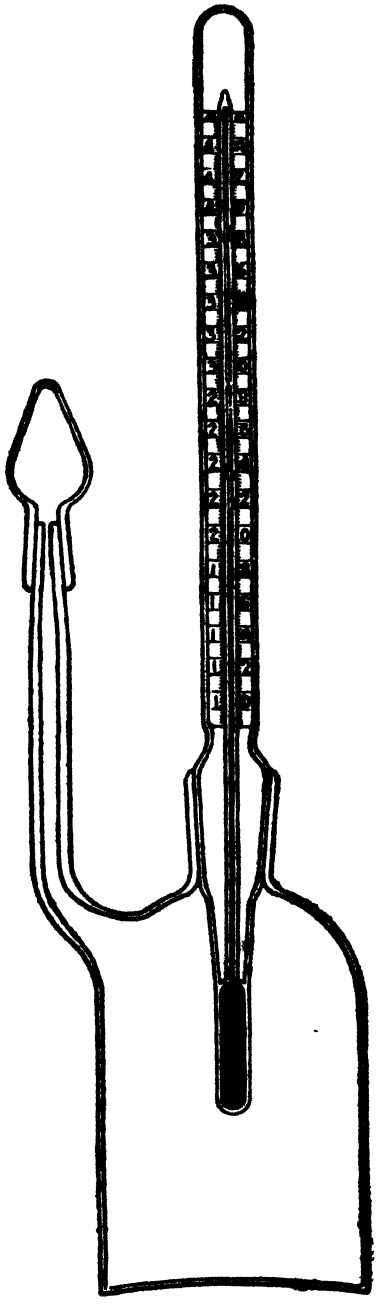
1520 – A Method for the Determination of the Specific Gravity of Wheat and Other Cereals.

BAILEY, C. H. and THOMAS, L. M.: *U. S. Department of Agriculture, Bureau of Plant Industry, Circular* No. 99, 7 pp. + 1 fig. Washington, August 23, 1912.

In buying and selling wheat great importance is placed on the density of the wheat kernels, the various degrees of which affect to a considerable extent the commercial grading and the price that the wheat will command.

Of a large number of liquids tried in these experiments for specific gravity determinations, toluene was found to possess most nearly the required properties, in that it has : 1) relatively low specific gravity ; 2) a low surface tension ; 3) a fairly high boiling point, insuring not too high volatility ; 4) physical constants ; including specific gravity, viscosity, etc. that will not change materially on exposure to the atmosphere ; and 5) a non solvent action on the constituents of the kernel.

By employing a liquid medium of this character it is possible to use a specific-gravity bottle, or picnometer. All determinations are made at the temperature of 20° C. A capillary side tube serves as a convenient overflow for the excess toluene when the bottle is filled at temperatures below 20° C. A small cap is used to cover the side tube when the thermometer registers 20° C. and to hold that which passes up this tube as the contents of the bottle reach the room temperature. The capacity of the picnometer is ascertained by weighing it when filled with distilled water



Picnometer for the determination of the specific gravity of wheat.

at 20°C. Each lot of toluene must be tested, as there may be a slight variation in its specific gravity.

Ten grams of the cleaned wheat sample (the exact weight being recorded) are placed in the picnometer, and a sufficient quantity of cooled toluene is added to a little more than cover the wheat. The cap is placed on the capillary tube, the neck of the picnometer connected with the filter pump, or aspirtor, and the air gradually exhausted. This promotes the escape of the air from the mass and particularly that held under the surface hairs and in the creases of the kernels. When the air bubbles cease to be given off, the vacuum is released for a moment and the bottle is then reexhausted. When no more bubbles rise, the picnometer is disconnected from the pump and completely filled with toluene cooled to about 18° C. The thermometer is then placed tightly in the neck of the bottle and the temperature of bottle and contents allowed to rise gradually to exactly 20° C. The last drop on the end of the capillary tube is removed with a piece of filter paper, the overflow cap set firmly in place, and the picnometer and contents weighed on an analytical balance. The specific gravity of the sample is calculated according to the following formula:

$$\text{Specific gravity of the wheat} = \frac{\text{specific gravity of the toluene} \times \text{weight of the wheat}}{\text{Weight of the toluene displaced by the wheat.}}$$

Commercial toluene can be used instead of chemically pure toluene. The commercial product, costing 35 to 40 cents a pound, has a specific gravity of about 0,8667 and will not change materially if kept in a cool place in a tight bottle.

The results obtained without applying suction when toluene was used were not correct.

The method here described gives very uniform results and is entirely satisfactory. Since this method was devised, the correlation of specific gravity with the quality of wheat has been undertaken. It appears very probable from the work so far that this test, with others, will prove of value in indicating kernel structure, milling quality, and flour yield of wheat.

1521 – Analysis of Tunisian Soy Beans.

Analyse du Soya Tunisien. — *L'Agriculture Pratique des Pays Chauds*, Year 12, No. 113, p. 167. Paris, 1912.

The Colonial Garden of the Ministry of the Colonies in Paris has lately examined some soy beans grown in the Experiment Garden of Tunis from seed supplied by the former establishment to the General Direction of Agriculture in the Protectorate of Tunis.

The chemical analysis of these beans gave the following results :

Water	7.18 %
Nitrogenous matter	41.40 %
Fatty matter	17.80 %

The content of fatty matter should be considered as normal. The commercial investigations entrusted to different agents in connection with the Colonial Garden resulted in corresponding results. These soy beans were judged to have good marketable qualities and to be likely to find a ready sale.

1522 - **Wheat Hay.**

FORAGE CROPS. MEADOWS AND PASTURES

PERKINS, A. J. (Principal Roseworthy Agricultural College) ; PHILIPPS, J. H. (State Agricultural Chemist) ; SPAFFORD, W. J. (Assistant Experimentalist) ; MAY, N. S. (Assistant Analyst). Wheaten Hay : Investigations as to what Stage of Development to Cut to Best Advantage. — *The Journal of the Department of Agriculture of South Australia*, Vol. XV, No. 11, pp. 1133-1150, 5 figs. Adelaide, June 1912.

Australia is the first country which has made much use of immature wheat for forage purposes ; and it is believed by the writers that it is still the only country in which this practice is extensively carried out. This is mainly due to the fact that Australia is a new agricultural country free from traditional prejudices. Hence Australian farmers have had to acquire everything pertaining to the handling of wheaten hay from practically unaided local experience. Nor, it is said, has this local experience as yet become so definitely and rigidly established as to preclude the possibility of improvements or variations on existing practices. Hence it has occurred to the writers that " a series of systematic investigations into some of the questions affecting the making of wheaten hay, as it is practised in South Australia, would not be without value."

The scope of the present article is limited to questions affecting the stage of development of the wheat crop most suitable to the making of hay. Incidentally, too, attention is drawn to various questions relating to the growth and the ripening of the wheat crop itself. The experiments upon which the various data and conclusions are based were conducted on the Roseworthy Agricultural College Farm during the course of the 1911-12 season.

Influence on Yields of Stage of Growth of Hay Crop. — In Table I, are shown the results of weighing plots of 1-100 of an acre, together with the calculated yields of hay to the acre.

TABLE I.

Showing Green and Dry Weigh s of Hay Cut at Various Stages of Growth.

Sample	When Cut	Remarks	Weight from 1/100 of an Acre — Green	Dry	Hay yield per Acre Tons.	Cwt.	lbs.	Loss of Moisture on Drying
—	—	—	lbs.	lbs.				%
A	Sep. 22	Full bloom	150.50	58.36	2	12	2	61.22
B	» 30	Grain just formed . .	180.50	73.74	3	5	94	59.15
C	Oct. 6	Grain full size; milky,	147.75	69.07	3	1	75	53.25
D	» 15	Grain leaving milky stage; most flag dry	152.00	76.89	3	8	73	49.41
E	» 21	Grain just in dough stage; all flag dry .	143.75	78.42	3	10	2	45.45
F	» 28	Grain full and plump, but still soft; straw pale gold	97.50	65.65	2	18	69	32.67
G	Nov. 4	Grain leaving dough stage, but not quite dry	73.50	60.45	2	13	109	17.76

From these data it is stated that the heaviest yield of hay was secured at the fifth cut, when the grain was entering upon the soft dough stage; whilst by the usual commercial standards the best quality hay was yielded by the third and fourth cuts, harvested respectively when the grain was distinctly milky in the first instance, and when it was about to leave the milky stage in the second.

Relative Proportions in the Successive Cuts of Hay, of Ears on the one hand, and of Flag and Culms on the other. — As soon as the hay was sufficiently dry it was weighed in the field, and immediately afterwards the ears were carefully separated from the culms and weighed separately. The results obtained are summarized in Table II.

TABLE II. — *Showing Relative Proportions in Successive Cuts of Hay of Ears on the one hand, and Culms and Flag on the other.*

Sample —	Total Dry Weight per 1/100 Acre. — lbs.	Dry Weight of Ears per 1/100 Acre. lbs.	Dry Weight of Culms and Flag per 1/100 Acre. lbs.	Percentage of Ears in Total Dry Weight %
A	58.36	7.82	50.54	13.40
B	73.74	10.66	63.08	14.46
C	69.07	9.25	59.82	13.39
D	76.89	17.09	59.80	22.23
E	78.42	22.13	56.29	28.22
F	65.65	21.85	43.80	33.28
G	60.45	21.87	38.58	36.18

These results bring out several points to which attention is drawn.

" 1. So long as the grain continues in the milky stage, notwithstanding the general increase in the total weight of the plants, the relative proportions between the ears on the one hand, and the culms and flag on the other, remain approximately the same. In our results, during this period, the heads dried to the consistency of hay represented from 13 per cent. to 14 per cent. of the total weight of the hay. We conclude, therefore, that during this stage of development of the plant the elaboration of organic matter by the green parts of the plant is able to keep pace with the progressive development of the ears, without placing an appreciable strain on the original supplies of the culms and flag.

" 2. As soon, however, as the grain begins to leave the milky stage, exemplified in sample D, the weight of culms and flag first comes to a standstill, and subsequently declines very perceptibly. This loss of weight increases in importance as the grain approaches complete maturity.

" 3. This loss of weight in culms and flag is accompanied by corresponding increases on the part of the ears.

" 4. The increases in weight of the ears, however, come to a standstill once the grain has become frankly doughy. Thereafter, the more complete ripening of the grain is not accompanied by any perceptible increase in the weight of the ears. This fact is clearly brought out in Table II with reference to samples E, F, and G.

" 5. Culms and flag continue to lose weight even after the ears cease to make perceptible gains ; hence, as maturity advances, a total dead loss in dry matter of the standing crop. This loss is to be attributed partly to the fall of the exhausted flag, partly to the fact that assimilation either comes to a standstill in the economy of the plant, or else is not sufficiently active to make good the losses of organic matter that always accompany normal respiration ; and partly too, perhaps, as we shall have occasion to see later on, because as maturity approaches, the mineral matter in stems and flag shows a tendency to migrate towards the root system."

Chemical Composition of Samples of Hay Cut at Various Stages of Maturity. — The results of the analysis of samples of each cut are summarised in Table III.

These figures serve to bring out the following points :

" 1. The percentage of ash or mineral matter remains substantially the same in culms and flag from full bloom time to the complete maturity of the grain. Over the same period of time mineral matter appears to decline steadily in the ears, in which organic matter may be taken to accumulate gradually as the ripening process proceeds.

" 2. The proteins, or flesh-building materials, are more abundantly present throughout the period under consideration in the ears than in the culms and flag.

TABLE III.

Showing Composition of Hay Cut at Various Stages of Development expressed as percentages of Oven-dried Material.

Samples	Ash		Proteins		Fat		Carbohydrates		Fibre	
	Ears	Culms and Flag	Ears	Culms and Flag	Ears	Culms and Flag	Ears	Culms and Flag	Ears	Culms and Flag
	%	%	%	%	%	%	%	%	%	%
A	6.98	7.61	14.94	9.06	1.84	1.36	50.11	52.32	26.13	29.65
B	6.38	7.83	12.76	7.87	1.42	0.90	52.43	54.15	27.02	29.25
C	6.60	7.56	13.37	7.06	1.14	0.94	58.07	54.79	20.82	29.65
D	5.98	8.16	11.56	7.37	1.10	1.10	63.61	51.35	17.75	32.02
E	5.56	7.96	10.87	6.62	1.20	1.00	67.69	49.94	14.68	34.48
F	4.82	7.18	10.56	5.44	1.36	1.06	70.42	48.37	12.84	37.95
G	5.46	7.25	11.31	6.50	1.46	1.08	69.22	49.17	12.55	36.00

" 3. In both ears on the one hand, and in culms and flag on the other, the percentage of proteins present declines steadily as the ripening process advances. Hence hay cut comparatively early may be taken to be appreciably richer in flesh-forming materials than hay cut somewhat too close to the complete maturity of the grain.

" 4. The proportion of fat, or oil-like materials, is slightly greater in the ears than in culms and flag. On the whole, however, there appears to be very little difference in the general proportions of fat present in the hay whatever the stage of development it may have been cut.

" 5. The carbohydrates, which in the cereals are represented chiefly by starch, are appreciably more abundant in culms and flag than in the ears in the early days that succeed full bloom. So soon, however, as the grain has attained its full size the percentage of carbohydrates in the ears begins to exceed that present in culms and flags, and the closer we approach the full maturity of the grain the more pronounced does this difference become.

" 6. In the ears the percentage of carbohydrates shows a steady rise from full bloom time to the maturity of the grain. It is represented by 50 per cent. of the dry matter in the ears when the plants are in bloom, and by 70 per cent. when the grain is ripe.

" 7. In culms and flag there is a slow rise in the percentage of carbohydrates present between bloom time and the time when the milky grain

reaches its full size, but thereafter there appears to be a steady decline in the starch contents of culms and flag, presumably to the immediate gain of the ears.

"8. The proportion of fibre — the most indigestible material in plants — present in both ears on the one hand, and in culms and flag on the other, is always higher in the latter than in the former. In the earlier stages, however, and until the grain has attained to its full dimensions, this difference between the two is comparatively slight. It becomes very pronounced, however, as the maturity of the crop advances.

"9. In the ears the percentage of fibre present declines steadily from the period of full bloom to the complete ripening of the grain. This percentage was represented by 26 per cent. when the plants were in bloom, and by 12½ per cent. when the grain was ripe.

"10. In culms and flag the percentage of fibre present steadily increases from period to period. It was represented by 29 per cent. when the plants were in bloom, and by 36 per cent. when the grain was ripe."

In Table IV, the figures in Table III are recast so as to show the feed unit percentages in the dry matter of the hay itself, representing a combination of both ears, on the one hand, and culms and flag on the other.

TABLE IV.

Showing Composition of Wheaten Hay Cut at Various Stages of Maturity expressed as percentages of Total Dry Matter and as Ponnds per Ton of Hay containing 15 per cent. of Moisture.

Sample	Ash		Proteins		Fat	
	Percentage of Dry Matter	Lbs. to Ton of Hay at 15 % Moisture	Percentage of Dry Matter	Lbs. to Ton of Hay at 15 % Moisture	Percentage of Dry Matter	Lbs. to Ton of Hay at 15 % Moisture
	%	lbs.	%	lbs.	%	lbs.
A. . . .	7.53	143.29	9.85	187.51	1.43	27.11
B. . . .	7.63	145.09	8.58	163.31	0.99	18.57
C. . . .	7.43	141.50	7.90	150.51	0.96	18.41
D. . . .	7.68	146.14	8.30	158.06	1.10	20.95
E. . . .	7.28	138.66	7.82	148.88	1.06	20.12
F. . . .	6.39	121.75	7.14	136.02	1.16	22.09
G. . . .	6.61	125.71	8.24	156.89	1.22	23.18

Samples	Carbohydrates		Fibre		Organic matter	
	Percentage of Dry Matter	Lbs. to Ton of Hay at 15 % Moisture	Percentage of Dry Matter	Lbs. to Ton of Hay at 15 % Moisture	Percentage of Dry Matter	Lbs. to Ton of Hay at 15 % Moisture
	%	lbs.	%	lbs.	%	lbs.
A. . . .	52.02	990.53	29.18	555.56	92.48	1 760.71
B. . . .	53.90	1 026.28	28.93	550.78	92.40	1 758.94
C. . . .	55.23	1 051.56	28.47	542.03	92.56	1 762.51
D. . . .	54.07	1 029.60	28.85	549.26	92.32	1 757.87
E. . . .	54.95	1 046.23	28.89	550.11	92.72	1 765.34
F. . . .	55.71	1 060.69	29.59	563.46	93.60	1 782.26
G. . . .	56.42	1 074.32	27.52	523.90	93.40	1 778.29

The Relation of the Composition of Wheaten Hay to the Cutting Period. — The figures in Table V. emphasize the fact that as maturity advances culms and flag are slowly robbed of their nutriment by the swelling ears, and become in consequence more and more straw-like.

TABLE V.

Showing Distribution of Hay Constituents in Ears on the one hand, and in Culms and Flag on the other, at Various Stages of Maturity, Expressed as Pounds per Acre.

Sample	Dry matter			Ash			Proteins			Fat		
	Ears	Culms and Flag	Total	Ears	Culms and Flag	Total	Ears	Culms and Flag	Total	Ears	Culms and Flag	Total
	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.
A.	665	4 296	4 961	46	327	373	99	389	488	12	58	70
B.	906	5 362	6 268	58	420	478	115	422	537	13	48	61
C.	786	5 085	5 871	52	384	436	105	359	464	9	48	57
D	1 453	5 083	6 536	87	415	502	168	375	543	16	56	72
E.	1 881	4 785	6 666	105	381	486	204	317	521	23	48	71
F.	1 857	3 723	5 580	90	267	357	196	203	399	25	39	64
G	1 859	3 279	5 138	101	238	339	210	213	423	27	35	62

Sample	Fibre			Carbohydrates			Organic matter		
	Ears	Culms and Flag	Total	Ears	Culms and Flag	Total	Ears	Culms and Flag	Total
	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.
A	174	1 274	1 448	333	2 248	2 581	618	3 969	4 587
B	245	1 568	1 813	475	2 904	2 379	848	4 942	5 790
C	164	1 508	1 672	456	2 786	3 242	734	4 701	5 435
D	258	1 628	1 886	924	2 610	3 534	1 366	4 669	6 035
E	276	1 645	1 921	1 273	2 390	3 663	1 776	4 400	6 176
F	238	1 413	1 651	1 308	1 801	3 109	1 767	3 456	5 223
G	233	1 180	1 413	1 287	1 612	2 899	1 757	3 040	4 797

General Provisional Conclusions. — From the above results of the partial experiments of a single season, the following tentative suggestions are put forward.

" I. Those who wish to secure the heaviest yields of wheaten hay to the acre must defer putting the binders into the field until the grain has fully reached the dough stage.

" II. Hay secured at this stage of maturity will prove dry and bleached, and carry with it a large proportion of grain. It will probably be more or less indigestible and, weight for weight, will not be the equal as a foodstuff of hay cut at earlier stages.

" III. Those who cut wheaten hay late with a view to securing heavy yields must carry out the work with the utmost expedition, since a tendency towards the shrinkage of yields will set in very soon after the maximum has been reached.

" IV. The highest quality hay will be secured if cut when the grain is full size, but still in the milky stage.

" V. In hay cut at this stage, ears, culms, and flag will all prove equally nutritious, and if carefully cured will show a bright color and a small quantity of shrivelled grain.

" VI. The usual commercial standards for quality in wheaten hay — color and shrivelled grain — are, in our opinion, amply justified."

1523 - Experiments in Growing Turkestan Lucerne in Hungary.

1. GYÁRFÁS, G. (Director of the Royal Agricultural Experiment Station at Magyaróvár, Hungary). A Turkestani lucerna termelési értékének mégallapitására vonatkozó kisérletek eredménye, örszágos m. kir. növény termelési, kisérlets állomas, Magyaróvárott. *Kisérletügyi Közlemények*, Vol. XV, No. 2, pp. 191-208. Budapest, May-June, 1912.

2. ID. Anbauversuche mit Turkestaner Luzerne in Ungarn. — *Illustrierte Landwirtschaftliche Zeitung*, Year 32, No. 72, pp. 655-656. Berlin, September 7, 1912.

The Agricultural Experiment Station at Magyaróvár (Ungarische Altenburg in German) conducted in 1909-1911 a series of experiments, on several farms in Hungary, with the object of ascertaining the value of Turkestan lucerne in comparison with that of Hungarian lucerne. The best results were obtained in the experiment fields of the Station.

	Green forage	
	Turkestan lucerne	Hungarian lucerne
	Cwt. per acre	Cwt. per acre
Rich clay soil:	1909	
1st cut	18.50	8.30
2nd »	35.44	33.23
3rd »	62.70	59.60
4th »	6.97	28.91
Total	123.61	130.04
	1910	
1st cut	144.00	157.87
2nd »	98.77	109.44
3rd »	103.62	120.75
4th »	48.59	81.96
Total	394.98	470.02
Poor clay soil:	1910	
1st cut	35.44	35.76
2nd »	32.58	29.95
3rd »	2.95	11.63
Total	70.97	77.34
	1911	
1st cut	91.87	101.80
2nd »	46.04	83.08
3rd »	8.52	15.13
Total	146.40	200.01

These results, and still more markedly those obtained by other experimenters, point to the inferiority of Turkestan lucerne in comparison with the Hungarian. Besides which the former did not present any

greater degree of resistance to frost and to drought than the latter, whilst its reproductivity was less, its growth slower and its period of vegetation shorter; so that not only does it yield a smaller quantity of forage but this is also much more mixed with weeds and other grasses. Exceptionally, however, either in the first periods of its introduction or in others, Turkestan lucerne does sometimes give a cut equal to and even above the corresponding cut of Hungarian lucerne, but this superiority soon disappears.

1524 - **Cultivation of Cotton in the Hungry Steppes.** FIBRE CROPS.

BUSHNIEFF, M. Opétnoie Polie Golodnaia Step v 1909 Godu. — *Otcheti o Sostolanja i Dietatelnosti Opetnekh Khlopkovekh Ucrezdenii v Turkestanie i Zakaspiiskoi Oblasti v 1909 Godu* (Report on the condition and work of the Cotton Experiment Stations in the districts of Turkestan and Transcaspia in the year 1909), Part IV, pp. 5 - 42. St. Petersburg, 1912.

Meteorological Conditions in the Year 1909. In the hungry steppes of Turkestan, when invasions of locusts do not occur, and on condition of irrigation measures still more extensive than at the present time, one of the most suitable and fruitful crops is unquestionably cotton. In the above memorandum there are set out the results of cultivation tests with some varieties of cotton, carried out in 1909 in the Agricultural Experiment Station for the Steppes.

The weather conditions of the year were marked by the following features: the mean temperature which prevailed during the growing period from April 15 to September 15 was 23.6° C., that is 2.4° C. less than that during the preceding five years, with a total of 3600° C. instead of 4000° C. The distribution of this factor was, however, highly favourable to the first stages of growth of cotton; in April we have a mean of + 19.4° C. (3.3° more than the five years' mean) and in May 25.8° C. (2.2° more than the mean).

The rains were less abundant than in the preceding years, 28 mm. in all, the months of July, August and September moreover being completely dry. Cloudiness in summer and spring exceeded the mean (20 % as against 15 %), but from September onwards, on the other hand, was below (13 % as against 14 %). Evaporation during the 5 months from sowing until ripening amounted to 600 mm. (nearly 100 mm. more than the mean). The relative moisture was 53.8 %, with a maximum of 76 % in April and a minimum of 47.3 % in July.

Most suitable Varieties of Cotton. In the experiment station, as generally throughout Turkestan, the best results are obtained with the species *Gossypium hirsutum*, the American variety "Upland". *G. barbadense* is not favourable because of its low yield and late maturity; in view however of the very good quality of its fibre, it might well be used for crossing and selection.

In the year 1909, 24 varieties were subjected to special study, of which 16 were entirely new for Turkestan, the others having been already grown for a long time and acclimatised. For these latter we have the following data : King gave about 19 cwt. of raw cotton per acre ; Ounce Boll, 18 ½ cwt. ; Hawkins 14 ½ cwt. and Russell 13 ½ cwt. It will be seen that the conditions thought favourable to ripening, which extended through the greater part of the autumn, enabled late maturing varieties like Hawkins and Russell to give results most certainly satisfactory. The highest yield in clean fibre was obtained from King, 34.6 per cent. (in percentage of the weight of raw cotton), the lowest from the varieties of *Gossypium herbaceum* : 26 per cent. The average was 32.3 per cent. which however in the third picking drops to 31.3 and in the fourth to 30.5.

The yield of " straw " (the whole of the parts above ground freed from the capsules and dried) averaged 15 ¼ cwt. ; per acre, 90 per cent. ; of the raw cotton, with a minimum of 80 per cent. for King and a maximum of 180 per cent. for Hawkins.

From the 16 new varieties introduced, the respective results were : Allen × King, 13 ½ cwt. ; Blue Ribbon 12 ¾ cwt. ; and Excelsior Prolific 11 ¼ cwt. of cotton per acre. The Egyptian varieties Afifi and Aschmouni (*G. barbadense*) yielded little — 4 ⅓ and 5 ½ cwt., but the excellence of the product is an inducement to the undertaking of attempts at acclimatisation and selection which may be effective in gradually raising its productivity. In point of fibre yield some of these new varieties exceed even King, as Triumph, Moss Improved and Gold Standard, which yield an average of 25.3 to 35.6 per cent. of clean fibre. A like superiority is noted as regards the length of fibre : Aschmouni and Afifi, 32 to 34 mm. ; Excelsior Prolific, 32 mm ; Southern Hope, 29.5 mm. ; Blue Ribbon 31 mm. ; Allen × King, 27 mm. (King, 25 mm.).

Effect of the Quality of the Seed on the Crop. — Experiments were made with selected and non-selected seeds of Russell, with large seeds and with small seeds of Fergan and seeds treated with formalin and others not so treated, with the results shown in the table on the opposite page.

Selecting the sowing material from the earliest maturing or from the most productive plants, clearly evident results are at once obtained in the first crop : in the first case 292 lbs. in the second 152 lbs. of raw cotton per acre above the yield obtained from the use of non-selected seeds.

Selecting by size again, positive results are secured ; the small seeds give rise to earlier maturing plants and therefore there is a larger quantity of fibre than with bulky seeds. Perfectly evident moreover is the action of formalin, which accelerates the process of germination and ensures a noteworthy uniformity of growth of the seedlings in the first stages of their development.

Quality of seed	Date of sowing	Date of maturity	Crop of raw cotton: lbs. per acre	Percentage of raw cotton of the 1st picking	First picking
Selected seeds of early maturing specimens	18 IV	30 VII	877	84	15 IX
Selected seeds of highly productive specimens	»	8 VIII	737	85	—
Unselected seeds	»	14 »	585	62	—
Small seeds (Fergan)	2 V	16 VIII	877	64	19 IX
Bulky seeds (Fergan)	»	20 »	807	58	»
Seeds steeped in water	2 V	16 VIII	975	52	19 IX
Seeds treated with formalin . .	»	19 »	836	57	»

Depth of Sowing. Sowing was carried out in various ways:

1) With Banner drill with roll.
2) With Banner drill without roll.
3) With Banner drill, and subsequent thorough harrowing.
4) Shallow sowing (2 in.) with Banner drill.
5) Deep sowing (7 in.) with the same drill.

The following results were obtained:

1. The best seedlings, densest and earliest, were observed on the plot where drilling was followed by harrowing but not rolling.

2. Mediocre results with the Banner drill fitted with roll.

3. Poor results sowing without roll or harrow.

4. Shallow sowing (2 in.) yielded dense, luxuriant and early seedlings.

5. Deep sowing, on the contrary, produced feeble and sparse plants.

Number of Plants per Hole and Distance between the Holes. On this very important question, still much disputed and discussed, the Author furnishes many valuable data. The experiments were so conducted as to have in one case one plant per hole at three distances: 28 in., 21 in.; and 14 in.; in a second case two, and in a third three plants per hole, the groups being the same distances apart as in the first case. The results, tabulated on the next page, show that rather dense sowing yields the best results, although the plants are individually less developed than those resulting from wide sowing.

Number of plot	Distance between holes of one row (*)	Number of plants per hole	Number of plants per acre	Growth of branches: Height of plant	Growth of branches: Average length of branches	Growth of branches: Number of branches	Number of capsules per plant: Total	Number of capsules per plant: Fully formed	Number of capsules per plant: Ripened	Number of capsules per plant: Not fully formed	Crop: cwt. per acre	Percentage of first picking to total crop
	in.			in.								
1	14...	1	19 055	39.8	19.7	18	21	12	8	14	10 1/4	35
2		2	38 110	36 2	17.3	16	13	8	5	18	18 1/4	42
3		3	57 165	36.2	17.3	15	11	6	4	10	20	36
4	21...	1	12 370	41.4	26.0	17	32	23	8	15	12	21
5		2	24 740	43.0	24.5	16	17	11	5	10	15	24
6		3	37 110	44.6	20.5	15	16	11	4	9	19	27
7	28...	1	7 666	48.1	26.0	20	44	29	15	14	12	19
8		2	15 332	41.4	27.5	17	27	20	6	15	12	26
9		3	22 998	43.0	26.0	18	76	12	4	10	12 3/4	40

(*) Rows all 36 in. apart.

Number of plot	Period and number of irrigations: Before flowering	During flowering	Before ripening	Total number of irrigations	Depth of water	Development of the plant: Height	Average length of branches	Number of branches	Number of capsules: Complete formation reached	Ripe at the time of the first picking	Not completely formed and fallen	Yield: cwt per acre	Percentage of first picking to total crop
					in.	in.	in.						
1	1	1	1	3	9.3	34.6	17.3	12	13	3	8	6 1/2	25
2	2	2	1	5	14.8	40.5	15.7	16	21	2	7	6 1/2	10
3	—	2	—	2	8.0	42.1	18.9	14	17	4	6	6 3/4	25
4	2	3	—	5	19.3	43.3	18.9	16	16	3	12	6	20
5	1	3	—	4	7.8	43.3	15.7	15	18	3	6	8	16
6	1	3	—	4	10.7	44.9	18.9	16	27	1	10	7 1/4	10
7	1	4	—	5	11.6	48.4	20.5	17	27	1	17	7 1/4	8
8	1	3	—	4	8.25	37.6	17.3	14	21	5	10	6 3/4	20

The figures and data are certainly not to be taken absolutely or generalised ; they vary according to the local meteorological and agrogeological conditions. In this case, for the hungry steppes, we have as the optimum rules : *a*) number of plants per hole, three ; *b*) distance between the holes, 14 in. ; *c*) distance apart of rows, 36 in.

How and when the Plantation should be Irrigated. The trials on this point were carried out with the object of determining the minimum quantity of water required to obtain a good crop and the best manner of distributing it in relation to the phases of growth of the plant.

The young shoots appeared on May 8, flowering began on June 23, and ripening started on August 20 ; the first, second and third crop were gathered respectively on September 18 and October 6 and 23.

As seen from the table on the opposite page, the highest yield of raw cotton was obtained in the case of four irrigations with a total depth of water of 7.8 in. The worst results were secured with five irrigations and a depth of water of about 20 in. This is explained by the lowering of temperature produced by the cold water, this lowering having mpaired the growth of the plants and consequently retarded the phase of ripening.

The best results are obtained with three or four irrigations applied during the period of flowering or with three during and one immediately after the flowering phase.

Manuring. Green manure is the most suitable and least expensive for cotton plantations in Turkestan ; very well adapted for this purpose is *Phaseolus Mungo*, owing to its luxuriant growth and the short duration of the vegetative period. With green manure an extra 2 $^3/_4$ cwt. per acre of raw cotton is obtained.

1525 – Experiments in Cotton Cultivation at the Experiment Station of Karaiasi, Transcaucasia.

DMITRIEVSKI, V. Karaiaskoie Opétnoie Polie. — Opéti s Khlopchatnikom — *Otcheti o Sostoianii i Dieiatelnosti Opetnekh Polei i Plantagii Promisclennekh Rastenii v Vostocnom i Sapadnom Sakavkasie V* 1909 *Goda.* (Reports on the Conditions and Work of the Experiment Stations of East and West Transcaucasia), Part III, pp. 8-11. St. Petersburg, 1912.

In continuation of the researches of preceding years, selection experiments were made in 1909 at the Experiment Station of Karaiasi (Transcaucasia), based on the colour of the seed of the King variety of cotton. As a rule, green seeds give a more abundant and finer fibre than those of other coours. Thus, 27 lbs. of green seed were sown in a plot of ground previously used for growing water-melons and dunged. The seed was sown in two lines 14 in. apart ; in each line, holes 28 in. distant from one another were dug, and three seeds placed in each. Cotton is much more susceptible than other crops to the harmful effect of weeds ; care was therefore taken to keep the field as free from weeds as possible. The flowering sea-

son began on July 1 ; the bolls began to open in the second half of August, and at the same time the rust appeared to an alarming extent in the plantation. Nevertheless, the crop of raw cotton was very large, *viz.* 17½ cwt. per acre, and better than that obtained from plots sown with seeds of different colours.

Before picking began, the plants least attacked by rust were marked and also the finest, most productive and earliest ; these were separated from the others and were destined for further selection experiments.

The researches made for the purpose of determining if the crop varied according as seed from the first, second, or third picking was chosen, also presented points of interest. Two different plots were sown with seed from the first and third pickings respectively, and cultivated in a similar manner. In both cases the seeds came up and the plants flowered and reached maturity at the same dates. There was only a slight difference in the yield, which was a little light in the plot sown with the seed from the later picking ; this is explained by the fact that the last picking includes seeds which are unripe and incapable of germination.

SUGAR CROPS.

1526 – **The Relation between Rainfall and Sugar Cane Crop in Mauritius.**

Rapport entre la quantité de pluies et la récolte de Canne à sucre à l'Ile Maurice Coupe et Fabrication. — *Colony of Mauritius, Station agronomique, Rapport annuel pour* 1911, *Bulletin* No. 26, pp. 17-19. Maurice, 1912.

The two following tables show the relation between the rainfall and the sugar-cane crop. It will be noticed, that the amount of rain is very different in the cultural year from that which falls in the calendar year and that, in the course of several cultural years, the amount of rain from April to October varies in comparison with that from November to March. It is the last which determines the greater or less production ; thus, while the rainfall during the cultural season of 1911 was 1830 mm., and in 1910 only 1342 mm., the crop of the latter year was larger (when the rainfall between April and October was 39 per cent. of the total) than in 1911 (when the summer precipitations were only 16 per cent. of the total).

I. — *Distribution of rain (in mm.) during the two periods of the cultural season.*

	1906	1907	1908	1909	1910	1911
November to March . . .	1261	709	1829	1236	885	1534
April to October	453	749	425	721	461	296
Total . . .	1714	1458	2254	1957	1342	1830

II. — *Sugar cane crop in relation to rainfall*

	Rainfall		Crop in thousands of tons
	during the year	during the growing season	
	—	—	—
1897	1245	779	122
1898	1434	1509	179
1899	1664	1775	157
1900	1081	1018	183
1901	1995	1697	153
1902	1736	1802	141
1903	1386	1586	215
1904	1448	1434	142
1905	2410	2088	182
1906	1429	1714	220
1907	1798	1458	155
1908	1896	2254	197
1909	1921	1957	245
1910	1532	1342	215
1911	1560	1830	168

1527 – **The Mineral Composition of Sugar Cane at Different Seasons of the Year.**

Composition minérale de la Canne à sucre à diverses époques de l'année. — *Colony of Mauritius, Station agronomique, Rapport annuel pour* 1911, *Bulletin* No. 26, pp. 28-46. Maurice, 1912.

The composition of sugar cane varies and is modified according to the vegetative period, both in its sugar content, and in the nature and proportion of the mineral compounds, which it obtains from the soil. Naturally, the absolute quantity of these compounds increases regularly with the total weight of the crop, but their relative quantities vary as much in the percentage composition of the ash as in that of the normal substance, or of the dry matter ; certain substances increase or diminish in the plant tissues according to the vegetative activity.

A series of tables published in this Bulletin give the composition of two crops, the first of Big Tana and the second of Cannes No. 133, in both cases when they were putting out fresh shoots and from month to month during the period of active vegetation, that is to say, from the moment the cane begins to form to the time of harvest.

In order to calculate the sum of compounds contained by the crop at different periods of growth, it is necessary to estimate the weight of this crop — canes and leaves, at these different times, which is done by calculating the amount of growth made by the canes between the dates at which the samples are taken. These measurements are taken, using the precautions suggested by the writer, until the time of harvest, and at this date, the different average canes selected for samples are cut into pieces representing

Percentage Composition of Big Tana Canes.

	May	June	July	Aug.	Sept.	Nov.
Silica	36.42	47.77	43.40	43.73	48.12	41.22
Chlorine	4.96	3.15	3.43	2.72	2.30	2.69
Sulphuric acid	4.54	4.80	3.46	3.35	3.02	4.59
Phosphoric acid	3.37	3.67	4.01	5.06	5.07	6.17
Lime	4.68	4.43	5.88	5.14	5.59	6.04
Magnesia	5.65	7.43	7.61	9.10	8.81	10.31
Potash	34.00	22.30	24.28	25.25	21.92	23.66
Soda	0.43	0.20	1.72	0.35	0.48	0.35
Oxide of iron	2.83	2.37	3.40	2.30	2.31	2.86
Carbonic acid, etc.	3.12	3.88	2.81	3.00	2.38	2.11
	100.00	100.00	100.00	100.00	100.00	100.00

Percentage Composition of Big Tana Leaves.

	May	June	July	Aug.	Sept.	Nov.
Silica	36.70	42.70	37.94	36.52	42.11	40.42
Chlorine	5.21	7.10	8.56	9.22	8.99	8.65
Sulphuric acid	3.81	3.22	2.88	2.28	2.23	2.73
Phosphoric acid	4.47	3.63	3.78	3.56	3.13	2.95
Lime	5.85	6.36	6.70	5.25	5.42	5.82
Magnesia	5.01	6.04	6.55	6.61	7.01	5.25
Potash	32.00	25.62	27.85	30.71	24.77	28.36
Soda	0.46	0.51	0.94	0.66	1.10	0.90
Oxide of iron	0.99	3.54	1.12	1.09	1.04	1.32
Carbonic acid, etc.	5,50	1.28	3.67	4.10	4.21	3.60
	100.00	100.00	100.00	100.00	100.00	100.00

the growth attained by each individual stem. These pieces are weighed separately, which gives the increase of weight ; this is compared with the growth in length ; from the different figures obtained, the average weight of the crop at the time of analysis is found. The same cane is split into two equal parts in order to estimate its sugar and its mineral content.

The analyses entered on the tables give for the two crops :

1. The percentage ash composition of canes and leaves.
2. The content of mineral and of natural substances.
3. The mineral substance content of the dry substance.
4. The composition of the whole crop, canes and leaves.

On the opposite page are the data for Big Tana regarding the percentage ash composition at different times.

1528 - The Argan-Tree and Argan Oil in Morocco.

OIL CROPS.

MOREAU. L'Arganier et l'huile d'Argan au Maroc — *Bulletin du Comité de l'Afrique Française*, Year 22, No. 9, pp. 372-373. Paris, September 1912.

The Argan-tree (*Argania Sideroxylon*) (1), which is an evergreen resembling the olive in appearance, has prickly young shoots and attains a height of 23 or 26 feet. It appears to grow only between latitudes 29° and 32° on the Moroccan coast, penetrating inland for a distance of 24 miles on an average. M. Gentil supposes that its excessive limitation is a question of climate, but the tree is met with at two places, where the climatic conditions are very different, and the question does not yet appear to be decided.

The Argan-tree flowers in June. Its fruit (argan) is of a greenish colour veined with red when ripe ; it is a drupe and almost always one-seeded ; its size is very variable, generally about that of a fine olive. The ripe drupe usually encloses one stone containing an oblong white bitter kernel. The fruits which fall to the ground become over-ripe ; the part outside the stone has then the appearance of a hard brownish paste, covered with a drier pericarp. This paste-like envelope then contains a tenth part of its weight of glucose and the tannin, which is no longer perceptible to the taste, has given place to saccharine matter.

The tree is easily raised from seed. Argan oil is much appreciated by the inhabitants of Morocco (2). Exportion was forbidden under heavy penalties. The French Consul at Mogador was able to procure several litres of genuine argan oil for his analysis, which is the first of this product that has been made.

(1) See No. 2713, *B.* Aug.-Sept.-Oct. 1911. (*Ed.*).

(2) The production of argan oil amounts in good seasons to about 6 600 000 lbs., which is used exclusively for local consumption. Cf. Capus et Bois : *Les Produits Coloniaux*, p. 308. (Paris, 1912). (*Ed.*).

The oil is prepared as follows: the thick shell of the stone is cracked and the kernels are roasted on earthen plates till they are brown, and then crushed by hand mills. The paste thus obtained is treated with tepid water, and the oil, which rises to the surface, is decanted off. The residual cake is hard, brown and bitter. It can be fed to animals, excepting horses, which refuse it. The oil separated from the water is brownish and has a very disagreeable taste. It is refined by heating it with a piece of bread, which apparently absorbs the bitter principles. The oil, when purified, is dark yellow, and tastes something like walnut oil. On an average 25 fruits, pulp and stones, weigh 100 grammes. The stones represent the half of this weight and yield about an eighth of their weight of kernels. These contain on an average:

	per cent.	
Fixed oil	68	
Moisture	6.15	
Ash	2.06	
Celluloses and other matters	23.79	by difference

The composition of the cake is as follows:

	per cent.
Water	27
Ash	3.60
Fatty matters	17.30
Celluloses, starch, etc.	52.10

It contains 6.23 per cent. of nitrogen; and the ash has 1.35 per cent. of phosphoric acid. This cake contains a special principle, "arganine."

RUBBER, GUM AND RESIN PLANTS.

1529 - **Some Rubber-Producing Species of *Landolphia* in the East of Madagascar.**

JUMELLE, H. AND PERRIER DE LA BATHIE. Quelques Landolphia à caoutchouc de l'Est de Madagascar. — *L'Agriculture Pratique des Pays Chauds*, Year 12, No. 113, pp. 89-98. Paris, August 1912.

The writers continue their exploration of Madagascar and mention other species of *Landolphia* which produce rubber. In this memoir, after a description and determination of the lianas which they collected at Analamazaotra, the writers state that *Landolphia Mandrianambo*, called in the south-east of the island "herotravahy", "voahena" at Analamazaotra and "mandrianambo" at Masoala, is a liana very widely distributed on the eastern slope of Madagascar. Unfortunately only old stems yield rubber and some large stems appear to produce none. *Landolphia Richardiana*, or "talandoha," occurs plentifully on the same slope in the sandy zone. Its production seems as capricious as that of the first species.

The " fingibahea " of Analamazaotra and the north-east is more interesting from the cultural point of view ; this species is *Landolphia corticata* and not *L. Dubardi*, which appears also to be a rubber liana, but concerning which we have at present no precise information. *Landolphia corticata* is a new species created by the writers and bears the same popular name as *L. Dubardi*, which has doubtless been the cause of the confusion. The writers, however, by means of a very careful description, show the differences between the two species and demonstrate that *L. corticata*, so called from the thickness of its bark, resembles at first sight *L. crassipes*. The specimens of *L. corticata* were collected at a height of 700 metres (2 300 ft.) ; the plant can be cultivated at the greatest altitudes and is an excellent liana for the production of rubber. Experiments made in the laboratory show that one stem of this liana can furnish 273 gr. of rubber, and that the normal content of its bark can be valued at 4.9 per cent. M. Louval, General Conservator of the Forests of Madagascar and Director of the Foresting Services, who has provided the writers with many specimens collected in the Masoala peninsula, is trying to propagate *L. corticata* by layers. Taking cuttings in the ordinary manner appears not to have given food results.

1530 – Tobacco-Growing in Italy in 1910-1911. VARIOUS CROPS.

Coltivazione dei tabacchi in Italia nel 1910-1911. — *Ministero delle Finanze. Direzione generale delle Privative. Bollettino Tecnico della coltivazione dei tabacchi pubblicato per cura del R. Istituto sperimentale in Scafati* (*Salerno*), Year XI, No. 4, pp. 193-206. Scafati, July-August 1912.

The following data have been obtained from the *Relazione e Bilancio Industriale dell'Azienda dei Tabacchi per l'esercizio dal* 1 *luglio* 1910 *al* 30 *giugno* 1911 (Ministero delle Finanze, Direzione generale delle Privative, Roma, 1912).

Tobacco-growing in Italy is a rapidly increasing and a promising industry, as is shown by the following table :

Form of concession	Area cultivated during the agricultural seasons		
	1905	1909	1910
	acres	acres	acres
Plantations for manufacture (*)			
Concessions by public announcement	12 445.9	13 199.7	14 117.4
Experiments in co-operation with the State	50.3	615.5	827.1
Special concessions	312.0	2 766.6	3 862.8
Cultural experiments for the production of tobacco for nicotine	—	—	134.1
Total for manufacture	12 808.1	16 581.8	18 941.4
Cultivation for export	1 218.7	3 745.4	2 722.3
General Total	14 026.8	20 327.3	21 663.7

* Cultivation for manufacture has been carried out in two ways ; by " concessions by public announcement " and by " special concessions ". According to the first, the only

During the industrial year 1910-1911, which includes the results of the season of 1910, the total expenses incurred by cultural work (the fixed salaries of the staff, whether permanent or not, indemnities for change of residence, compensations and subsidies; payment of subordinate inspectors, of labourers employed in counting the leaves, gratuities to labourers, consumption of different articles and materials, various expenses of maintenance; adaptation and improvement or renting of premises) amounted to 2 494 756 l. (£98 998 5*s.*). During the same season, there was acquired for the State factories, 8 707 089 kg. (19 195 842 lbs.) of native tobacco costing 6 950 099 l. (£275 797 11*s.* 6*d.*) with an increase of 900 972 kg. (1 986 303 lbs.) and of 526 594 l. (£20 896 11*s.* 6*d.*) on the preceding financial year. There were 115 860 350 plants planted out in the open; of these 7 666 680 died, so that 108 193 850 were grown, *viz.* 4 480 993 more than in the preceding season.

Nearly everywhere unfavourable atmospheric conditions prevailed, which occasioned a smaller and inferior harvest: 6 937 280 kg. (15 294 082 lbs.) costing 75.14 l. per quintal (£1 10*s.* 3½*d.* per cwt.) tobacco delivered dry to the State, *viz.* a decrease of 1.61 l. (7 ¾*d.*) on the price of the preceding crop. The above figures do not represent the total harvest, for they do not include the produce of 5 956 356 plants of the Levant variety, which have to be prepared by private manufacturers and consigned, next season, to the monopoly Office. In adding to the cost of the above-mentioned tobaccos the expenses of the direction and superintendence of the crops and those of treating and preparing the leaf, the average real cost is 102.42 l. per quintal (£2 1*s.* 3½*d.* per cwt.) allowing for the increased cost due to losses of weight, about 6 per cent., which the tobacco suffers during preparation and during the time preceding its packing in bales.

During the saeson of 1910, there were 16 experiment fields; 12 were under the Kentucky type of tobacco, 2 under Levantine and bright sorts, and two under different varieties for cutting.

method employed until the last few years, the Ministry of Finance has the power of conceding annually, by public announcement, a certain number of plants to a territorial district of several communes and constituting a "Cultivation Agency". The consignment of plants assigned to an Agency is divided amongst the different cultivators of the district, on application. The Agency undertakes to furnish a minimum of plants, which can be reduced or increased according to whether the number obtained in adding these minima together is greater or less than that which has been conceded. The tobacco thus produced is consigned to the Agency's storehouses when it is properly dry, but before it is fermented. In the case of "special concessions", autonomous centres of cultivation are formed in each of which the agent attends, not only to the production, but also to the forwarding of the product to the monoply office in a definite state of preparation for commerce. (Ministero delle Finanze, Direzione generale delle privative. *Istruzioni pratiche sulla coltivazione del tabacco nei suoi rapporti col Monopolio.* Roma, 1907). (*Ed.*).

The cultivation of tobacco for export, which had developed in a very intensive manner during the last 4 years, experienced a considerable check during the season of 1910 owing to causes which must be sought for in the want of success in commercial undertakings.

During the year 1910-1911, the Institute of Scafati made important nicotine experiments on 994 varieties of tobacco, of which 712 were ordinary varieties and 282 were hybrids. These experiments have been extended to the different means of obtaining the seeds, to manuring, and the fermentation and preparation of tobacco.

1531 – The Cabbage Palms of Madagascar.

JUMELLE, H. AND PERRIER DE LA BATHIE, H. Les Choux-Palmistes de Madagascar. — *Comptes Rendus des Séances de l'Académie des Sciences*, Vol. 155, No. 13, pp. 587-589. Paris, September 23, 1912.

The palms of which the terminal bud is consumed like a cabbage belong to very different species, though they are often, and usually, Arecineæ. To this tribe belong most of the Malagasy palms and from many of them is gathered this vegetable, which is much appreciated in hot countries.

The species of *Chrysalidocarpus* called *C. oleraceus* by the writers ("madiovozina" of the Betsileo, "herihery" of the Sakalava, and "hizohazo" in Ambongo), furnishes a very good palm-cabbage, in the West of Madagascar; while that obtained from *C. ferrugineus*, which grows in the same districts, is uneatable and even considered to be poisonous by the natives.

A palm-tree growing in the East, in the neighbourhood of Mt. Vatovavy, bears an excellent terminal bud; this species is the *Neodypsis basilongus* of the writers and probably is the same as *Chrysalidocarpus decipiens* Becc. The buds of *Chrysalidocarpus mananjarensis*, one of those called "lafa" by the natives, are also edible, as are those of *Neodypsis tanalensis*, another "lafa" and "matitanana" of the Tanala; but these other buds, though good for eating, are a little bitter. Those of *Adelodypsis gracilis* ("hova" of the Tanala and also "tsobolo") and of *Chrysalidocarpus Baronii* Becc. ("rehazo"), which grows in the forests of the dunes on the east coast, are still more bitter. The buds of the species called by the writers *Neodypsis nauseosus* ("rahamé"), which grows in the dry forests of Vatovavy, are absolutely uneatable.

In the north-west of the island, *Borassus flabellifer* ("dimaka" of the Sakalava) is found; this also yields a good palm-cabbage.

MARKET GARDENING.

1532 - Industrial Cultivation of Tomatoes in Vaucluse, France.

BOUVILLY, A. Culture industriel des Tomates en Vaucluse. — *Journal d'Agriculture pratique*, Year 76, Vol. II. No. 37, pp. 336-339. Paris, September 12, 1912.

At Jonquières, a place in Vaucluse, and in its neighbourhood, about 150 acres are devoted to tomato-growing ; this plant can there no longer be considered a market-garden crop, but is a true field-crop, and the produce, which is destined to provide seed and also tomato paste, all goes to the same factory. As the seeds are furnished to growers by the factory, the varieties grown are very numerous and include nearly all the kinds celebrated for their productivity : Rouge Hâtive, Reine des Hâtives, Trophy, Chemin Rouge Hâtive, Perdrigeon, Merveille des Marchés, Perfection, Mikado, Champion, Ponderosa Ecarlate, Tige-raide de Laye, Zacharia, Jaune Grosse, etc.

Sowing is done in January in florists' earthen-pans ; the plants thus obtained are pricked out in February into frames at about 3 in. apart. When the seedlings become too much crowded, they are again transplanted. All these transplantings, which are done before the seedlings are definitely planted out, and made with care, so as to preserve each time a little mould adhering to the roots, cause an abundant branching of the rootlets and strengthen the young plant.

Planting out is effected during May. The soil of the district is a marly alluvium, of recent formation, the deposit of the Rhone and the Ouvèze ; it is admirably suited to tomatoes, which like light soils, rich in humus and damp, but without an excess of moisture.

The ground is prepared by autumn ploughing, which serves to turn under 8 tons of dung per acre ; another ploughing in the spring completes the aeration of the soil, which receives, as additional fertilizers, 3 ¼ cwt. of superphosphate and 2 cwt. of chloride of potash. The complete preparation of the soil is effected by harrowing and rolling.

For planting, lines 3 ft. 3 in. to 4 ft. apart are marked out by an implement and the tomatoes are placed at intervals of 1 ft. 9 in. to 2 ft. The practice of pinching off the shoots allows of closer planting, increases the production, and gives rise to better nourished, more fleshy fruits, bearing better seeds, but naturally entails more labour.

Whatever method of cultivation is adopted, watering is begun directly after planting, and when a week has elapsed, an application of nitrate of soda can be made at the rate of 1 ¼ cwt. per acre. Each application of the manure should be followed by hoeing. Further, frequent hoeings should be carried out, for the soil must always be kept clean and moist. Towards the end of June, or the beginning of July, the plants should be earthed up to 1 ¼ or 1 ½ in. Finally, to protect the crops from the attacks of *Phytophthora infestans* they should be sprayed during June with a copper wash : 2 % of sulphate of copper and an equal amount of lime.

If pinching off is practised, only some clusters of flowers are kept, and the buds above are removed, in order to prevent the formation of too many fruits, which would be badly nourished and poorly developed.

The harvest begins in August and ends at the close of October. The average crop is over 13 tons of fruit per acre.

1533 – The Production of Early Vegetables on the Algerian Coast.

BERTHAULT, P. La production des Primeurs sur la côte algéroise. — *Revue Horticole*, Year 84, No. 18, pp. 418-421. Paris, September 16, 1912.

Nearly the whole of the Algerian coast, from Cape Matifou to Hussein-Dey, and that portion which extends north and west of the town from Pescade point to Sidi-Ferruch, is occupied by vegetable crops. Further, large quantities of Chasselas grapes are grown at Guyotville.

Through this long strip of land, bordering the shore for a distance of about 18 miles, the nature of the soil is very variable. Fine silicious sands alternate with fairly deep alluvial soil and some crystalline nuclei, without this very variable composition of the soil modifying the distribution of the crops. The liberal supply of water and manures ensures a fine growth to the vegetables, while the temperature of the coast is the exclusive factor in its suitability for the cultivation of early crops. At Guyotville, the thermometer never falls below + 4° C. (39° F.) and the brilliance of the light allows all horticultural plants to grow throughout the whole winter. The commune of Guyotville alone has 1500 acres under Chasselas and sends off annually, by way of Algiers, 8 to 9 thousand tons of grapes. If to this be added the export of 15 to 20 thousand tons of early vegetables (19 900 tons in 1911) and that of 8 thousand tons of fresh vegetables (8 500 tons in 1911), some idea is obtained of the great importance of vegetable growing in the neighbourhood of Algiers.

Vines are always grown in the dry sands, but vegetables are produced both on dry and irrigated soil ; the water-table is at little depth throughout nearly the whole length of the coast. All the crops are protected from the wind, but quick hedges are very rare in this district, as they are injurious to the plants which they shelter ; thus they are almost entirely replaced by windbreaks of dry reeds and palms. The expense (7½*d.* per yard run) is still rather high, for these windbreaks only last for two years, and to be efficacious they must be very numerous. In a market-garden at Guyotville 320 yards are reckoned per acre of crops ; this represents an annual outlay of £4 4*s.* per acre.

The potato is one of the most important of the early vegetables. The most widely cultivated varieties are the Hollande with yellow flesh, which satisfies French taste, and Royal Kidney and Fluke, which have white flesh, and are thus much appreciated on the Englich markets. In order to prevent the degeneration which accompanies forcing, the seed-

potatoes are imported from France every year shortly after the harvest and planted in December, either on clear ground, or between lines of French beans, which are sown at the end of September and gathered during the last days of December. The seed-potatoes are planted on little ridges, which are usually watered, and about 16 cwt. of seed is used per acre. When the potatoes come up, which in the case of those grown with beans, corresponds with the harvesting of the latter, the soil is hoed and then slightly earthed up. Lifting begins at the end of January and goes on into May. The tubers are sorted according to size into three or four distinct lots. During the winter the largest are of little value in Paris, where the native produce is preferred, and they are sent to England and Hamburg. The average and small sized potatoes are, on the contrary, in great demand. In Paris, they constitute the so-called "new" potatoes and find a ready and remunerative sale.

The second crop is planted in July or August. At this date, it is impossible to obtain French tubers, which would not keep so long. The seed-potatoes used are therefore the last of the harvest gathered in Algeria in May, which are called in the neighbourhood of Algiers "Grenadines." After 50 days of growth, that is in October or November, they are lifted. As the French potatoes, which have recently come in, are appreciated in the markets of Paris, and the supply is sufficient, the amount of the second Algerian crop exported is rather small, and is chiefly sold on the markets of Algiers and Marseilles.

Potatoes intended for export, after having been sorted according to size, are packed in barrels containing 50, 100 or 150 kg. (110, 220 or 330 lbs.), and lined with grey paper. For England they are packed chiefly in cases of 25 or 50 kg. (55 or 110 lbs.) also lined with grey paper.

The cost price of growing one acre of potatoes is somewhat high, and varies from £14 10*s.* to £22 10*s.* The crop varies from 2 to 4 tons.

Next to potatoes, French beans are the most widely grown early vegetables of Algeria. They give two crops a year, and at Guyotville are often cultivated without irrigation amongst the Chasselas vines. The favourite varieties are the Flageolet Noir Long and Noir Demilong, Mouche à-l'œil, Gloire de Deuil and Métis de Conflans, the two last varieties being especially prized by exporters because the green beans do not wither much and travel well. Local seed is generally used; the seeds (about 1 lb. per rod) are sown in pockets on the ridges which at this season support potatoes, but on the opposite side. Sowing takes place about the middle of September for picking in December and January, and in December for picking in May. Three hoeings are intercalated between the frequent irrigations which are necessary for the spring crop. The crop is picked in December, or in April and May. This picking of French beans is rather expensive, coming to £2 15*s.* or £2 18*s.* per acre. A labourer, paid 2*s.* 6*d.* per day,

gathers from 110 to 130 lbs. of pods during the day, and one acre produces up to 2 700 lbs. of green pods.

The French beans, sorted according to quality, are put into baskets with bottoms and edges of woven lentisk and with sides of plaited rushes; they are covered with leaves and despatched at once. The sale price in the Paris markets varies according to the quality of the pods and the season, from £1 8*s.* to £2 12*s.* per cwt. Transport 7*s.*, loss due to evaporation, 7 per cent, and expenses of commission and sale reduce the price obtained by the producer to 13*s.* or 13*s.* 3*d.* per cwt. sold.

Green peas and artichokes, being more hardy, are scarcely grown now in the neighbourhood of Algiers.

Thanks to its various horticultural productions, the whole border of the Algerian coast is very prosperous. Land which 20 years ago was only worth £3 5*s.* to £4 per acre, now fetches no less than £96. At Guyotville more than £145 was given for the land last sold for growing early vegetables and over £220 for that for planting with Chasselas vines.

1534 - **The New Vine.** FRUIT-GROWING.

PÉE-LABY, E. La Vigne Nouvelle. — *La Vie Agricole et Rurale*, Nos. 27, 33 and 41, pp. 7-8, 186-189 and 396-399. Paris, June 1, July 13, and September 7, 1912.

By the new vine is meant a certain number of vines obtained by hybridization, which are cultivated for their grapes, under the names of "hybrid bearers" or "direct bearers." These hybrids have been in great favour of late years, and in 1912 it was impossible to meet all the demands from France and from abroad for cuttings for planting.

The hybrid bearers have this great advantage, that they are more hardy than French stocks (French *vinifera*). They have much more power of resistance to fungus diseases, are very productive, and whatever the weather, always yield some crop. The wine they produce is relatively rich in alcohol, in acid and in dry extract.

It must not, however, be supposed that these hybrids, although they possess many great advantages, are destined everywhere to replace the French vine, which is more delicate and more subject to accidents and to disease of all kinds. The cultivation of hybrid bearers cannot replace that of the *vinifera* in large vineyards, like those of Bas-Languedoc and of the Bordelais, where the growers are organised only for the cultivation of the latter, and where they know all the virtues and defects of the two or three varieties which are grown and the necessary treatment for them. Hybrid bearers must, for the present, be confined to districts of mixed cultivation, or those where labour is scarce. For in such districts, the vine is not the principal crop, and the dates of the necessary treatments coincide with the general labour of hay-making and harvesting, and the work among the hoed crops, so that the owners will undertake to spray the

vines once, or even twice, with any mixture which will ensure to them a certain vintage, but will rarely spend the time to do more. This is, indeed, all that the hybrids require. In 1910, which was a most disastrous year for vines, the official Commission of Enquiry respecting the hybrid bearers of Haute-Garonne states that some of these hybrids gave a half crop.

At present, hybrid bearers are divided into two categories: "direct hybrids" and "hybrid grafts."

Direct hybrids. — These are so called, because they can be planted directly as cuttings without any intermediate grafting. Their roots are considered sufficiently resistant to phylloxera. Experiments carried on for twelve years prove that the following hybrids, which are to be found in the collections under the following names and figures can be planted without fear of loss in middling good and fairly deep soil in the South-West district:

Seibel, Nos. 2, 29, 63, 110, 128, 138, 156, 181, 209, 405, 1014, 1020, 1077, 2003, 2041, 2042.
Contassot, Nos. 7120, 7161.
Couderc, Nos. 503, 132-11, 4401.

There are certainly others belonging to these or other collections, which are called resistant, but which have, so far, not been tested in the district in question.

Soils which have a tendency to promote chlorosis are unsuitable for a large number of these hybrids, which generally speaking fear phylloxera less than lime. Thus, of the list quoted above, only the following vines are calciphilous:

Seibel, Nos. 63, 1014, 1020, 2041, 2042.
Couderc, No. 4401.

So it is seen that there are hybrids whose roots are resistant to both phylloxera and lime.

Hybrid grafts. — These are hybrids of which the resistance to chlorosis and phylloxera has been proved to be insufficient. But as, on the other hand, they are very resistant to fungus diseases and give a satisfactory crop of grapes, they have to be grown grafted upon suitable stocks.

As a result of careful and accurate experiments, a list has been drawn up of the hybrid grafts which are suitable for any particular stocks, both for ordinary sub-soils and for those inducing chlorosis. Consequently, there is no longer any difficulty in establishing a vineyard of given hybrids on any soil. Nevertheless, the grafting of hybrids is only a makeshift and should only be resorted to in the case of varieties of which the resistance to chlorosis and phylloxera has not been clearly proved, for it

has been observed that grafting is not beneficial. Thus Seibel Nos. 128, 1020 and 1077, which are able to grow on their own roots, are more productive as direct producers than when grafted, on the same soil.

Resistance to fungus diseases. — 1. The results of careful observations made in 1910, the year of the disastrous invasion of the mildew, prove that though repeated copper treatments were powerless to check the mildew on the leaves and fruit, some hybrids, which had not been sprayed, resisted the disease, although growing in infected surroundings and kept their crop alnost, or quite, intact. Amongst the last may be mentioned in the South-West district :

Seibel, Nos. 2003, 2, 63, 2041, 2042, 2044, 138, 1000, 405, 54.
Couderc, Nos. 503, 4401, 28-112, 132-11.
Contassot, Nos. 7104, 7106, 7120.
Jurie, No. 580.

2. There are other hybrids which, with a few sprayings with copper mixtures (usually two, one before flowering and the other after), resist much better than French vines which have been liberally sprayed. These are the following black hybrids :

Seibel, Nos. 1020, 1077, 1070, 128, 156, 2006, 2007, 2010.

White hybrids :

Couderc, Nos. 146-51, 106-46, 272-60.
Girerd, No. 157.

There are other hybrids which are resistant to mildew or easily protected, but the writer does not possess sufficient data respecting these.

Resistance to Oidium. — Most of the black hybrids are not susceptible to this fungus, which is a fortunate circumstance, for they are as a rule very easily affected by the action of sulphur, which makes their leaves drop off rapidly. Consequently they are not treated with sulphur. Only Seibel 1070 and Couderc 4401 need to be protected from this disease.

The white hybrids are very sysceptible to oïdium and this explains their rarity; only the Couderc white hybrids resist fairly well, and Girerd 157 does not require sulphuring.

Resistance to anthracnose. — The hybrids appear less subject to this disease than the French vines, but are far from being immune.

Resistance to black-rot. — A certain number of hybrids, when left without treatment, are practically immune. Of these may be mentioned amongst the black hybrids :

Seibel, Nos. 2003, 150, 2041, 1020, 182, 138, 7120.
Couderc, Nos. 503, 25-112, 132-11.

Among the white hybrids:

Seibel, Nos. 857, 2658, and 2859 which is rose-coloured.
Couderc, Nos. 74-17 and 117-3.

It is also believed that the white Girerd No. 157 is little susceptible to black-rot.

Resistance to Conchylis or Eudemis. — The observations hitherto made are not numerous enough for it to be possible to speak definitely on this point; but it has been found that, owing doubtless to an absence of parallelism in the development of the hybrids and of *Conchylis* and *Eudemis*, the following hybrids in the South-West showed themselves to be resistant:

Seibel, Nos. 2, 2003, 2041, 2044, 1020, 1070.
Couderc, Nos. 503, 4401.

What is the nature of the wines produced by these hybrids? So far, whether white or red, these wines have none of the qualities proper to fine vintages, but are blending wines or suitable for immediate consumption. Nevertheless, the results of the last tastings have proved that certain wines made from hybrid vines were, taken as a whole, very superior to those from ordinary *vinifera* grown in the same district and on the same soil. It may be affirmed, without fear of contradiction, that the principal characters of these wines are the following:

Greater richness in dry extract, in acid and in alcohol than is generally shown by the wine made from French vines.

The objection made to red hybrid wines, that they are subject to "casse bleue," has been removed since certain stocks, such as the Jacquez and Terras and some other varieties, have no longer been grown. The new method of making wine from the grapes of these vines which now obtains, permits of vine-growers avoiding this trouble.

In conclusion, wine from these hybrids is much cheaper than that made from the produce of vines which it is impossible, in some years, to protect from fungus diseases.

The writer is convinced that, with the progress of hybridization, which is always possible, the quality of the hybrids and of their wines will continue to improve.

1535 - American Stocks for Cape Vineyards.

PEROLD, A. Y. and TRIBOLET, I. in *The Agricultural Journal of the Union of South Africa*, Vol. IV, Nos. 1-2, pp. 99-109 and 222-257. Pretoria, July and August 1912.

As reports of a serious nature about grafted vines failing in different parts of the vine districts have lately reached the Government Viticulturist (Dr. A. J. Perold), it was deemed necessary that a thorough investigation should be made of all grafted vines in the various viticultural areas

The data gathered during the tour of inspection on 106 farms are given; the following conclusions are drawn from them: —

With regard to the American stocks, irrespective of the varieties of grapes grafted on them, the following conclusions may be drawn from the foregoing data:

1. — Jacquez suffers and dies from phylloxera in stiff loams and clays (that get rather dry in summer); does well in many broken soils and light loams that do not suffer from drought in summer; does well in cool, deep, sandy soils. Hence, with the exception of stiff, dry clays, it could be planted on most soils in the Western Province. In the heavy, sweet loams and Karroo soils in the Worcester, Robertson, and Montagu Districts it will be unwise to plant Jacquez. In the deep and light alluvial soils in the Keisie, etc., Jacquez could be given a trial on a small scale to begin with.

2. — Metallica suffers and dies from phylloxera in heavy soils that get a little dry in summer; does fairly well in many broken soils, although the failures are here quite as numerous as the successes; does decidedly well in cool, deep, sandy soils, where these do not get too wet in winter. In these last-named soils the Metallica is easily attacked by root-eels (nematodes), which may become so bad as to kill the vines altogether. Hence, with the exception of decidedly cool and fairly loose soils that never get too dry and never too wet, Metallica can not be recommended as a graft-bearer. There are soils, such as at Goudini, Constantia, and other places, where Metallica does very well, but these are exceptions to the rule. There are better and more reliable stocks that can be used and ought to take its place in future.

3. — Aramon does well in all the cases that were examined, with the exception of the following: *a*) Kanaan on Aramon, five years, in a very stiff Karroo soil. These big vines having given very heavy crops up to the present may suffer from over production, whereby they were weakened and thus laid open to the attacks of the phylloxera. *b*) Hermitage, Black Prince, and Greengrape, two to six years old, on Aramon, in a sandy, broken, hill soil, suffer partly from phylloxera. This is probably due to drought. *c*) Hermitage on Aramon, in a stiff, dry potclay. There were vines on Aramon and Metallica, so that it is doubtful whether those on Aramon suffer much, especially since Aramon everywhere did well in clay soils.

Hence Aramon is one of the best stocks of the Cape Province. Where Metallica suffers from drought, and Rip. Gloire gives only small vines in certain hill soils, it still gives good results. In clay soils it is the best stock at present available. In certain deep and cool clay soils Riparia Gloire and Rupestris du Lot come up to it.

As is well known, there are two kinds of Aramon, namely, Aramon Rupestris Ganzin Nos. 1 and 2. They can be distinguished from one an-

other as follows: *a*) the tips of the young shoots of No. 1 are reddish brown and smooth, whereas those of No. 2 are lighter in colour, more greenish yellow, and distinctly woolly; *b*) the leaves of No. 1 get a reddish colour in April, when those of No. 2 are still green, and merely get yellow before dropping off the vines.

At this time of the year one can see the red-leaved Aramon sticks in all the nurseries of the Cape Province mixed up with the green-leaved No 2. In the writer's opinion there are more sticks of No. 2 than of No. 1 in the nurseries. In any case, they are now thoroughly mixed up in the vineyards, so that Aramon in the foregoing report refers to both Nos. 1 and 2 indiscriminately. They are both good stocks, although No. 1 is the stock mostly cultivated in other countries. It is an open question whether the Aramon failures were on No. 1 or 2 or both.

4. — Riparia Gloire de Montpellier was nowhere found suffering from phylloxera. In clay soils it does well so long as the clay is deep and fairly cool. In broken soils it does well, provided these soils are not too shallow so that they suffer from drought in summer. Where this proviso does not hold, the vines on Rip. Gloire remain too small. In deep, sandy soils it does very well if these are not too poor and dry.

In two instances Rip. Gloire was bad or unsatisfactory, namely, in one case where it stood in a reddish, broken mountain soil, that was fairly dry, and in another where it was planted in a heavy reddish loam on a hill. Both soils are not what one would regard as Riparia soils. In deep, loose river soils and cool mountain soils, as well as cool clay soils, Riparia Gloire answers very well. It resists drought better in these soils than either Metallica or Jacquez, regularly gives splendid crops, and brings its grapes to a perfect maturity. Hence it is a splndid stock when planted in a suitable soil. The objection that the stem is too long and slender only holds good in unsuitable soils. In proper Riparia soils it grows so vigorously as soon to develop a strong stem. Further, it is a good stock for Hanepoot, although this grape is sometimes inclined to run off a great deal on it. Altogether it should have been used much more than is actually the case in reconstituting the vineyards in the Western Province.

5. — Old Riparia should be discarded in favour of Riparia Gloire, which is everywhere superior to it.

6. — Rupestris du Lot, which is the same as Rup. Monticola (although altogether different from *Vitis monticola*), has thus far not been planted much. It is a good and vigorous stock, even in stiff and broken soils. It, however, wants a permeable sub-soil, and cannot stand much wet. In one case, some Kanaan vines on it were found suffering perhaps from phylloxera, although more likely from drought. In a stiff potclay soil, Hanepoot, of seventeen to eighteen years old, was found doing well on it.

It was very largely used in reconstituting the vineyards in the south of France, and has there given good results. Hence, and in view of the above, it deserves attention as a graftbearer, and should be experimented with in future.

7. — Abrikoosblaar or Blinkblaar Rupestris has in some cases proved to be a good stock. As it was, however, nowhere better than Aramon or Rip. Gloire when planted next to these, and as it is furthermore an ill-defined stock — there are no doubt several varieties known by the above names — there is no reason to recommend it as a graftbearer.

8. — Mourvèdre-Rupestris 1202 has only recently been used somewhat extensively as a graftbearer for Hanepoot, so that much cannot just now be said about it. It is, however, to be expected that it will do well in most cases. In very sandy soils it easily suffers from the attacks of root-eels, whereby it can be destroyed altogether. This great susceptibility to the attacks of root-eels it shares with Metallica. In other soils these need not be feared. It is a very vigorous grower, and has largely been planted in Europe, where it is regarded as an excellent graftbearer. It will probably be found of great value in reconstituting the vineyards in the Worcester, Robertson, and Montagu districts. This especially applies to Hanepoot, as the heavy loams and Karroo soils are nearly all unsuitable for either Jacquez or Riparia Gloire. Experiments are already being made to test its suitability for the above soils, it being not quite certain whether 1202 will sufficiently resist the phylloxera in these soils.

9. — Othello was sometimes used as a direct bearer and sometimes as a graftbearer. Its resistance against phylloxera is too low for it to be recommended as either a graftbearer or a direct bearer.

10. — Herbemont was found only in one case where it stood in a deep, sandy soil. This case is a striking instance of the influence of the stock on the graft. Where Hanepoot on Jacquez next to it gives vigorous vines, growing upright and bearing long, good bunches, the Hanepoot on this Herbemont forms low-growing somewhat creeping vines that bear well, but give short, round bunches, altogether different in shape from the ordinary Hanepoot bunch.

11. — Donkey or Le Roux Rupestris: The same remarks apply here as in No. 7 above.

1536 – On the Structure of the Flowers of Fruit Trees.

Novikov. M. Issledovanie Zvietov Plodovikh Dereviev. — *Selskoie Khoziaistvo i Liesovodstvo* (Agriculture and Forestry), Year LXXII, Part 7, pp. 331-343. St. Petersburg, 1912.

The subject of this article, which is at once descriptive and critical is the polymorphism of fruit trees in Russia. The importance of this prob, lem cannot escape the notice of those who are interested in pomology

based on the new theories of heredity, which have given of late years a great impulse to selection as the means of making improvements by the choice of correlative and allelomorphic characters.

The material for observation and study was furnished by 230 of the best and most widely-grown varieties of fruit-trees ; and 15 to 20 flowers of each variety were examined. For each of the flowers was determined the length of the stamens, the position of the anthers, the form, colour and dimensions of the petals, the length of the pistil and the number of styles.

Almond. — The average number of stamens varies from 21 to 36 (Grosse Sultane) ; the general average is 32. In the flowers taken separately, the difference is still more noticeable and the stamens number from 19 to 42. Their length varies considerably, not only between varieties, but also between the flowers of the same variety and of the same plant; this is the first fact of polymorphism. The average length is 7 mm. for Coque Tendre, 12 mm. for De Corse ; the general average is 9 mm. Another very clear evidence of polymorphism is shown in the length of the style, which on the same tree may vary from 7 to 20 mm. In the varieties De Corse and Hatch, the stigma is much above the anthers, so that self-fertilization is very difficult. In the varieties Coque Tendre, Grosse Sultane, Marie Dupyi, Princess and Pistache, three arrangements are met with: in some flowers the stigma is higher than the anthers, in others lower; and again, even on the some plant, anthers and stigma may be seen at the same level.

Apricot. — The average number of stamens varies from 23 to 39 in the different varieties ; the general average is 31 ; in the flowers taken separately, the number varies from 19 to 50. Their length is from 6 to 13 mm., with an average of 9mm., and varies from 4 to 14 mm. in individual flowers. Polymorphism is especially noticeable in the length and position of the pistil : in some cases, the style is double, in others it is reduced to the point of disappearing.

Plum. — 31 of the most important varieties were examined, with 4 of *Prunus japonica*, and 4 of wild plum ; also *Prunus Pissardi*, *P. graeca*, *P. incana* and *P. Cocomilia*. The average number of stamens in the different varieties varies from 20 to 45, with an average of 27 ; in individual flowers it was from 16 to 57. Their length is from 6 to 11 mm., and in the same flower there are nearly always short and long stamens. In almost all varieties, the stigma is above the anthers, sometimes at a considerable distance from them, and very seldom at the same level. These arrangements make pollination somewhat difficult. In the evident polymorphism of the variety Frankfurth, flowers are often met with in which the pistil is shorter than the stamens ; this is the normal condition in the wild *Prunus graeca*.

Peach. — Taking as a basis the dimensions of the petals, two types are to be distinguished : *a*) one with small petals, 6 to 10 mm. long, and 4 to

10 mm. wide ; *b*) the other with large petals, 14 to 18 mm. long and 11 to 17 mm. wide. Three groups can be distinguished according to the colour of the petals : 1) white, 2) light pink, 3) dark pink.

The comparative study of biometric data permits of two very different types of peach blossom being distinguished :

Type I : flowers with large pale-pink petals, stamens and pistils somewhat short and more or less concealed. This type recalls on the whole the flowers of the almond.

Type II : flowers with small scale[illegible]tals, a dark pink colour. The stamens and pistils are well developed and conspicuous. In this type can also be included the white-flowered variety.

1537 - **Ringing (Cincturing) Peach Trees.**

SOUTTER, R. in *Queensland Agricultural Journal*, Vol. XXIX, Part 2, pp. 162 - 164. Brisbane, August 1912.

Results of an experiment made at the Roma State Farm, Queensland.

Three trees which, though they had made extra vigorous growth, had produced very little fruit, were selected and treated as follows :

No. 1. — Had all its branches cinctured.

No. 2. — Control.

No. 3. — Had one branch cinctured.

The bark was removed from the branches in a spiral fashion, when the buds commenced to swell.

On tree No. 1, cuts from half an inch to an inch in width were made. There was no marked difference in the yield of fruit resulting from this, but at the close of the season it was noticeable that the smaller incision had completely healed over, thereby affording no inducement for borers, etc., to get a footing, whereas the wider incisions, though nearly covered over, did so. It may be stated here that all cuts were tarred over as a precautionary measure agaiust outside injury. The tree bore a good crop, considering the dry season and its previous performances.

The fruit was of good even quality, the earliest of which ripened before any on the untreated tree by from 10 to 14 days. Practically no windfalls were gathered ; a very few dropped off at stoning time.

From appearances it is believed that the effects of the treatment will be more marked next season, as very few sterile buds are noticeable throughout the tree.

No. 2. — Though so far as appearance went there was no great difference, if any, between the amount of blossom on this tree and that on No. 1, fewer set for fruit, and again, at stoning time many more were detached, so that at maturity only about half as many were found. Individual fruits of as good quality as on No. 1 were met with, but as a whole they were uneven in size and of poorer appearance and flavour. From

present appearance this tree will not produce one-quarter the blossom that No. 1 will.

No. 3. — The branch operated on on this tree bore the bulk of the fruit, all of which was of even size and quality. It produced also the first ripe fruit on the tree. The fruit on the other portion was similar to that found on No. 2.

1538 - **Banana Cultivation in Jamaica.**

LEVY, H. Q. Banana Cultivation (*Musa Sapientum*). — *The Journal of the Jamaica Agricultural Society*, Vol XVI, Nos. 1-8, pp. 29-33, 72-75, 210-212, 248-249, 305-307, 360-363, 438-439. Kingston, January to August 1912.

The writer, who is Agricultural Instructor, illustrates in a series of articles the cultivation of bananas under the conditions prevalent in Jamaica. He writes chiefly for the benefit of the beginner in banana growing and in describing the various methods practised, he discusses them critically in the light of his personal experience.

Soils. Soils on wich bananas can be *profitably* grown may be grouped under the following five heads :

1. Clays containing a large proportion of humus and other available plant food. These lands, if fresh, produce excellent crops for a number of years, with very little attention beyond good drainage and tillage, and the practice of ordinary cultural methods.

2. Clays of the Old Yellow Limestone formation. They mostly have an upper stratum of rich black or brownish deposit, with an underlying one of dense clay varying from a light yellow to a deep orange colour. The latter class of these lands may be found in the fertile area lying towards the upland centres of the island and form part of the parishes of St. Mary. St. James, Trelawny, Manchester, Clarendon and St. Ann. In some parts of these soils and where they have been very long under cultivation bananas can only be successfully grown by manuring and with the aid of mulching and blind trenching, for the top soil becomes very friable, allowing the humus to be easily washed out.

3. Coarse Limestone Clays, of a uniform dark yellow orange colour. These soils can be made to mature a fair crop of bananas if well mulched.

4. Rich Sandy Alluvial Deposits, such as the fertile plains of St. Catherine and of Vere and along level river banks. These soils are really ideal for banana cultivation, but being often situated in localities deficient in rainfall, systematic irrigation must be resorted to for good results. The writer expresses the fear that without the establishment of a regular system of drainage these lands will become waterlogged or full of alkali deposits.

5. Red soil of White Limestone formation, commonly called " red dirt soils." These are situated chiefly in St. Ann, Manchester and St. Elizabeth.

The special cultural methods that these soils require to ensure success are partly compensated by labour being cheaper and more plentiful than in other districts. It was demonstrated fully fourteen years ago that bananas could be profitably grown on these soils, and the writer quotes one instance in which a profit of £56 was made (in the early part of 1912) on a three-acre plantation, and another in which a profit of £223 3s. was yielded by a ten-acre lot, both being in the vicinity of Browns' Town, St Ann. The special cultural methods to be followed in these soils consist chiefly in mulching, never allowing the soil when once covered to become exposed to the rays of the sun. Next, before or after planting (the former for preference) the soil must be thoroughly forked, burying all vegetable matter to hand and seeing that the clods of soil are all pulverised. After having once forked, no subsequent forking must be attempted, as these red loams will not stand it. The roots of the banana when severed instead of making fresh growth as they do on clay or rich alluvial soil, die back to the bulb, giving a permanent set back to the plant.

Planting. — February, March and April are the best months to plant bananas, so as to meet the highest prices during the following spring. Planting in October should only be done in localities that have no spring rains. In the rich interior lands, situate at more or less high elevations, it has been the practice to plant from October to December, but the writer has demonstrated by actual experience that this is a mistake, because this practice entails two cleanings more than with spring planting; besides, the bunches produced have ill-shaped fingers and an unprepossessing colour and do not reach maturity much earlier than the others.

The writer advises planting in squares either 14 × 14 feet planting two suckers per hole, which gives 444 suckers per acre, or 11 × 11 feet with a single sucker per hole or 361 per acre. Planting at 15 × 15 ft. or 16 × 16 ft., carrying three suckers per stool, may be practised with success, as apparently, on the St. Catherine plains, but with the aid of irrigation. Such distances could not be recommended for other parts of the island.

For 14 × 14 ft. distances the holes should be 2 ft. 6 in. square × 16 inches deep, and for 11 × 11 ft., 18 inches square × 16 in. deep.

The Seed suckers used in planting bear different names according to their form and age: thus the *Sword* has sword-shaped leaves and is from two to eight feet in length, and it will be found better than any other for planting near over-hanging trees or woodland. A sword sucker to be of value as a plant must be at least six feet high and not more than eight. It must be planted in an upright position with all the leaves trimmed off, except the unopened heart one.

A *Sword cut back* to within eight inches of the bulb; this, instead of being planted in an upright or slanting position, should be placed flat on its side in the hole. These should be used exclusively on moist soils, and only when no better sucker can be procured.

The *Maiden sucker* cut back to within four or six inches of the bulb is the best seed sucker of all; it has passed the sword stage but does not yet show signs of fruiting; it is about eight months old. The writer recommends that the heart eye should be destroyed, all roots cut off and the outside eyes [illegible]ay, with the exception of the most pronounced one. The maiden sucker should always be planted in an upright position.

Heads, or bulbs of suckers from which fruit has been cut, can be safely used provided they are fresh, the bulb still showing a white colour and no signs of « sourness ». Only one well-pronounced eye must be left to grow.

Split Heads. Sometimes when heads are very large they are cut in halves, one eye being left on each piece. But the writer does not advise this method unless the land is fairly moist (not wet).

Some planters select their seed suckers two or four weeks in advance of planting, putting them in heaps covered with banana trash, but this method does not seem to offer any advantage.

Subsequent cultivation. — The operations following planting are: forking, if the land has not been forked previous to planting, and mulching. Whenever the land begins to get « tight », or baked, it is advisable to have it reforked. This however does not apply to the red soils in which it is better to renew the mulch.

In most cases it will be found that August and September are the best time for forking ratoon bananas, as by then the main crop should be off the trees; but if the crop was early and the land is moist (but not wet) July is still better.

Drainage. — On clay soils, thorough drainage is absolutely necessary. It not only improves the health of the plants, but it brings them into bearing earlier than on undrained land.

Mulching. — The importance of careful drainage on clay soils is equalled, if not exceeded, by the necessity of mulching the limestone clays and the red dirt soils. The mulch may be of any vegetable matter, such as banana or coconut trash, guinea grass, bush, etc. Guinea grass, however, especially the coarse variety, has been found to be the best. It should be slightly wilted by being allowed to lie, when cut, for a few days in the sun, before putting on the land.

It takes about three acres of good guinea grass to mulch one acre of bananas. The mulch must be applied immediately after planting and forking. If in December the mulch has worn thin it must be re-

plenished, to guard against February and March, as these are the most trying months for bananas on red soils.

Catch Crops. — Though the practice of growing catch crops in banana plantations is widely spread, the author deprecates it strongly, excepting when peas or beans are used.

Suckering or Pruning. — There is no part of banana cultivation that needs so much attention and judgment as pruning. One must know which suckers are to be removed and which to be retained. It is hardly possible to grow more than 450 stems per acre without injuring the «followers» (1); of this number 300 may be considered to give a profit. It is quite possible to grow six or seven hundred to the acre, but the «followers» and the fruit take so long to mature that not more than half the above amount can be cut in one year.

The object in suckering is not only to obtain size of bunch, but to meet the months of highest prices. A ten-hand bunch marketed in October fetches only 1s., one containing seven hands sold in April or May realizes the same price, with lower cost of marketing and less chance of rejection.

In pruning, clean cuts must be made and care taken not to cut more roots than necessary. The *green* leaves are not to be removed unless they interfere with the proper development of the bunch. Dry leaves may be pruned away during the colder months, but ought always to be left hanging against the trunk during the hot dry season as they help to keep the sun away from the tree.

After Cultivation. — Banana fields should be kept as far as possible free of weeds and creepers. On the St. Catherine plains and the light level lands of Portland, St. Mary and Clarendon, the 6-inch plough, disc harrow or 6-toothed expanding cultivator may be used to advantage. Where drains have been established, and on all other lands, the hoe or cutlass is used: two cleanings and one forking per annum give excellent results. On clays of limestone formation mulching instead of subsequent forking gives far better results, and if the mulch be thick, two cleanings are saved.

A highly beneficial though expensive practice is that followed by some planters who, after crop time, each alternate year, remove the «yams», or partly rotted heads, from the stool, filling up the holes thus made with new earth taken from the «bars» (2).

Ratooning. — It has been found more profitable to replant after taking off the crop from the 4th ratoon, some doing so after the 3rd ratoons

(1) Explained by the author as the suckers left at the root of the plant to produce the succeeding crop. (*Ed.*).

(2) Explained by the author as the spaces between adjacent stools. (*Ed.*).

with advantage. Anyhow, replanting should take place not later than the 5th year. At St. Catherine, where the soil is warm and there is irrigation to force the plants during the dry months, planting is carried out in the existing field, cutting down all suckers that will carry fruit beyond May. In other banana centres the whole field is stumped out before replanting.

Grading. — This term may refer to the degree of maturity of the fruit or to the size of the bunch. In the first case there are three grades :

1. *Round Full Fruit.* — When all the fingers from the top or largest hand down to the one before the last at the bottom present a smooth round surface. When the fingers of the bottom hand become perfectly round and smooth, and those in the top hand have a brown streak down their entire length on the exposed sides it is then called bursting full fruit. This quality is kept for home consumption.

2. — *Full Three Quarter.* — The top hand is nearly round, but the fingers still show four or five slightly defined ribs. On the other hands the ribs are well defined but the edges are not sharp.

3. — *Three Quarter or English Fruit.* — The fingers on all the hands, although plump, present four or five sharp ribs and the tips of the fingers still retain the remaining portion of the dried female flower.

When the grading refers to size of bunch, the grades are : « straight » or whole bunches of at least nine well-developed hands, the last with not less than twelve fingers ; « three quarter », of eight hands ; « half », of seven hands ; « quarter » of six ; « one eighth, » five. No extra price is paid for bunches containing more than nine hands.

Cost of Labour.

Irrigated Districts.

Clearing land generally done by cording the wood, price per cord 1*s.* or per acre	30	to	40*s.*	
Lining, per acre.	2	»	6*s.*	
Digging holes, ploughed land, per 100			1*s.*	6*d.*
Raw land, per 100			2*s.*	
Digging suckers, per 100			1*s.*	
Planting, day labour, per diem			1*s.*	6*d.*
Forking raw land, per acre,	20	to	25*s.*	
Forking ratoons, per acre	12	»	15	
Ploughing new land, per acre,			5*s.*	
Ploughing with 6-inch plough, per acre			2*s.*	6*d.*
Cultivating with disc harrow or cultivator, per acre			1*s.*	3*d.*
Digging drains, per cubic foot per chain				6*d.*
Cleaning drains, per chain, according to size and state of drain	3*d.*	to	1*s.*	

Weeding, per acre	7s.	6d.	»	10s.	
Suckering or pruning, generally done by day labour, per diem				2s.	6d.
Cutting fruit, day labour, per diem				2s.	
Carrying out fruit, per 100 stems				2s.	6d.

Non-irrigated Districts.

Clearing land, per acre		10	to	30s.	
Lining, per acre				2s.	
Digging holes, 2 ft. × 2 ft. × 18 inches, per 100		2	to	3s.	
Digging holes, 18 inches × 18 inches × 18 inches, per 100		1s.	to	1s.	6d.
Digging suckers, per 100		1s.	»	1s.	6d.
Purchasing suckers, per 100		4s.	to	6s.	
Planting, per 100		6d.	to	1s.	
Dropping suckers at holes, according to distance, per 300,		6d.	to	1s.	6d.
Forking raw land, per square	3s.	6d.	to	5s.	
Forking ratoons, per square		2s.	to	3s.	
Ploughing raw land, according to soil and roots, per acre.		10s.	»	14s.	
Ploughing ratoons, according to size of plough, per acre.	2s.	6d.	»	4s.	6d.
Digging drains, per cubic foot per chain					6d.
Spreading earth taken from trenches, per chain		3d.	to	4½d.	
Cleaning drains, according to size and quality of dirt and drains, per chain		4½d.	to	1s.	6d.
Weeding, per square		9d.	to	1s.	6d.
Brushing weeds (instead of weeding), per square				1s.	6d.
Suckering, if by day labour, with supervision (which is much the better plan) per diem				1s.	6d.
If by task, per acre		9d.	to	2s.	6d.
Cutting fruit, per 100		9d.	to	1s.	
Carrying out fruit, according to distance and grade, per 100	2s.	6d.	to	8s.	4d.
Cutting grass for mulching, per load.		4½d	to	6d.	
(Five bundles to a heap, eight heaps to a load, an armful counts as a bundle. An acre will take from 80 to 120 loads, according to necessity of light or heavy mulching.)					
Bush mulching, generally by day labour for cutting and applying, depends on distance, per acre	£3	to	£5.		

The figures below represent the actual cost and returns per acre of a field of plant bananas cultivated by the writer a few years ago, on a "*red dirt*" soil of fair fertility, without manuring, and planted 14×14 ft., two separate seed suckers to each hole.

	£	s.	d.	£	s.	d.
440 Stems giving 70 per cent. payables, equal 308; average £9 per 100				27	8	0
Forking common pasture per square 4s.	2	0	0			
If guinea grass pasture add 2s. 3d. per square for hoeing up the grass.						
Lining, per acre	0	2	0			
Digging holes, 2 ft. 6 inches × 18 inches × 18 inches, 222; per 100, 3s. 6d.	0	7	9			
Suckers delivered; 440 average, at 5s. 100	1	0	0			
Dropping suckers for	0	6	0			
Planting	0	5	0			
Supplying	0	1	6			
Mulching with guinea grass, cutting, carrying and spreading. If bush mulch be used, cost will be about £1. 10s. more	3	0	0			
Weeding twice, 20 squares; per square 9d.	0	15	0			
Pruning	0	4	0			
Cutting and heading	1	0	0			
Carting 8 miles to wharf, 440 stems at 1½ d.	2	15	0	11	16	3
Profit per acre				£15	11	9

1539 – Artificial Slow Ripening of the Deglet-nour Date.

SWINGLE, WALTER T. Maturation artificielle lente de la Datte Deglet-nour. — *Comptes Rendus des Séances de l'Académie des Sciences*, Vol. 155, No. 12 (Sept. 16, 1912), pp. 549-552. Paris, 1912.

In 1900, the writer introduced Algerian dates into the United States. Some date-palms were planted in Arizona and California in the hottest desert districts. Already in 1903, the Deglet-nour date palms began to bear fruit and continued to do so every year, but hitherto the dates have not ripened on the tree, although they were exposed in some places to a heat exceeding the temperature calculated to be necessary by the writer for their ripening in the Algerian Sahara.

It was therefore necessary to seek for artificial means of ripening these dates. In 1910, Mr. Geo. F. Freeman, of the University of Arizona, found that incubation was a method of ripening them quickly and far surpassed all the chemical methods hitherto tried. According to this system, which has been improved by Mr. Bruce Drummond, it is possible by using a temperature of 43°-49° C. to ripen the dates in less than 24 hours, and the fruit contains almost the same proportion of cane sugar and inverted sugars as the dates from Algeria. The resulting fruit is much appreciated in America.

The writer thinks that the method of slow ripening at a low temperature is still better than incubation. The ripening of dates must be regarded as consisting of two distinct phases, the first, or "botanic maturation," is complete as soon as the fruit has reached its proper size and the seed has matured. Dates in this condition are large and soft, and yellow or red

according to the variety. They are very astringent and are uneatable. The second phase is the true maturation and consists of complicated chemical changes. The cane-sugar becomes invert sugar and the free tannin is deposited in the very large cells described by Tichomirow, Kearney and Lloyd.

The botanic maturation is brought about by means of a sufficient amount of heat, which in case of the late varieties, is only attained in districts with an extreme desert temperature. On the other hand, damp plays an essential part in true maturation. Dates cannot be ripened artificially, either by means of incubation, or by the slow method, if the air is dry. In artificial ripening it is necessary that the air surrounding the fruits should be saturated with the moisture which is given off by the dates as they dry and shrivel. In fact, the provisional boxes in which the Deglet-nour dates are sent from the oases to Biskra, Algiers or Marseilles, contain a mixture of dates loose and on branches so that the space between the branches is occupied by damp air. The Deglet-nour can ripen on the trees in many oases of the Algerian and Tunisian Sahara, but the extreme dryness of the autumn in the deserts of the South-East of the United States prevents their ripening completely on the tree.

The dates attain their full size in September or October; then they dry on the trees, shrivelling more or less. The result is a fruit which resembles the dried dates known as M'Kentichi more than the Deglet-nour variety as known in Algeria and Tunis.

It remains to be determined by experiment, what means are the most efficacious for slow artificial ripening, *i. e.* to discover the conditions of humidity and temperature which give the best results.

t540 - Tree Planting by Farmers. FORESTRY

TILLOTSON, C. R. — *Year-book of the United States Department of Agriculture*, 1911, pp. 258-268, plates XII-XIV. Washington, 1912.

Farmers are said to be responsible for nearly 90 per cent. of the approximately 1 000 000 acres of forest plantations in the United States to-day. Of these 1 000 000 acres, 860 000 are found in the so-called central treeless region (States of Illinois, Iowa, North Dakota, Nebraska, Kansas, the prairie district of Minnesota, and portions of Oklahoma and Texas west of the hardwood belt), 100 000 acres east of it, and 40 000 acres west.

In the older settled portion of the treeless region the area of planted timber is decreasing. Plantations of such rapid-growing species as white willow, soft maple, and common cotton-wood, established 30 or 40 years ago chiefly for protection from winds, are now being cut, because they are mature and for the most part are situated on land which is more valuable for agriculture than for the production of timber of low value. Future planting in this region is then likely to be confined to the establishment

Species and Methods for planting in different regions, and products which may be obtained from plantations.

SPECIES	Region to which tree is suited	Soil	Spacing	Planting	Products	Age
Cottonwood	Treeless	Moist soil; sandy river bottom best	15 by 15 feet; under plant with soft maple or plant 2 to 4 feet apart in rows	Plant cuttings in a furrow	Lumber and cordwood	30-40
Silver maple	do	Fresh to moist loams or sandy loams	6 by 8 feet	Sow seed direct	Cordwood	25-40
White willow	do.	do.	4 » 6 »	Plant cuttings in a furrow	Posts, cordwood	20
Green ash	Treeless, hardwood, north-east	Well drained loam soil	4 » 4 »	Sow seed direct	Handle material, farm timbers	40-50
White ash	do.	Well drained black or clay loams	do	do	do.	do
Hardy catalpa	Treeless, hardwood, north-east	Well-drained loams or sandy loams	6 by 8 feet	Slit method	Posts	18-20
Black walnut	Treeless, hardwood, north-east	do.	6 » 6 »	Sow seed direct	Lumber	50-75
Red oak	Hardwood, northeast	Sandy or clay soils	do.	do.	do	50
European larch	Treeless, hardwood	Well-drained loams or sandy loams	12 by 12 feet; fill in to a 6 by 6 foot spacing with white pine	Slit method	Poles, posts	25-40
White pine	Treeless, hardwood, north-east	Well-drained sandy or loam soils	6 by 6 feet	Slit or furrow method	Lumber	50
White spruce	Treeless, northeast	Fresh to moist loams	For windbreak 10 by 10 feet	do.	do.	60
Norway	Treeless, hardwood, north-east	do.	do.	Slit method	do.	50
Red pine	Treeless, northeast	Poor sandy or gravelly soils	6 by 8 feet	Sow seed direct; dig hole for each tree: slit method	do.	50-60

of narrow belts of some coniferous tree for the protection of farm buildings or to the production of timber from some such rapid growing species as hardy catalpa.

In the other portions of this treeless region planting is on the increase, chiefly for the purpose of protection, but partly, also, for the production of fence posts. East of the treeless region forest planting is also on the increase. This is due, among other reasons, to the decrease in the supply of native timber, the fact that considerable areas are more suitable for timber than for agricultural crops, and the expectation of quick and large returns from such trees as hardy catalpa and black locust. For these same reasons planting in these regions may be expected to increase in the future. In a number of States planting is also stimulated by competent State forest officers, and, in addition, in Ohio, Massachusetts, Connecticut, New York, Maryland, and Vermont, through distribution by the State of forest tree seedlings. West of the treeless region planting for future protection in irrigated districts and for timber production in those parts of California adapted to the growing of eucalyptus will undoubtedly increase.

It is believed that in future many farmers will be forced to raise their own timber for general farm use, or else pay an almost prohibitive price for it. In some sections of the country the price of posts has doubled in the last 10 to 15 years and may be expected to double again in the next 10-15 years. This article discusses briefly, for the region east of Nebraska, north of Tennessee and North Carolina, the best trees to plant, the methods to be followed in planting them, and the products they yield. For convenience the larger region is subdivided into three smaller ones: the treeless region, which includes the States of Iowa and Illinois; the hardwood region, enbracing Ohio, Indiana, Kentucky, and Southern Michigan; and the north-east region, embracing Pennsylvania, New York, and the Northeastern States.

The chief suggestions may be practically summed up in the accompanying table (see opposite page).

In addition to the products of the mature stand, as mentioned in the table, it must be remembered that thinnings will yield other material, such as cordwood and posts. No figures as to the monetary returns are given. It is, however, stated, that some lands, even if planted to the slower growing species, will show returns equal to if not greater than those that can be secured from the growing of agricultural crops. Moreover, that the values from timber crops, and the returns from plantations in the future may be expected to be greater than those from plantations in the past.

1541 – Improvements to be made in Cork Crop Operations.

TRABUT. Progrès à réaliser dans les opérations de Récolte du Liège. — *Bulletin agricole de l'Algérie et de la Tunisie*, Year 18, No. 13, pp. 293-299. Alger, 1912.

In order to strip cork trees, use has been made for a long time of the hatchet only, both for the horizontal incisions and the longitudinal cuts. As the blows of the hatchet when badly directed or violent produce many wounds which depreciate the tree and even result in its death, it has been attempted for some time in Algeria to limit the extent and depth of these injuries.

The use of a hand-saw for the removal of the circular layer was first introduced into Catalonia ; the example was followed in Algeria, and to-day the method is generally adopted in almost all cork stands. For longitudinal cuts however the use of the hatchet with all its disadvantages has been retained. To avoid them, a forest keeper in Algeria has designed a saw with a very convex blade which can be used with two hands so as to produce a longitudinal incision. The wooden mounting prevents the blade making its way beyond the cork layer ; the projection of the blade can easily be adjusted so as to render injuries to the bast layers impossible. The projection of the blade must be $^1/_5$ in. less than the thickness of the cork to be removed. The small layer left unsawn is no obstacle whatever to the detachment of the cork, indeed some trials have shown that even sawing the cork through two-thirds of its thickness only, it could be detached quite as well as when sawn right through.

To make the longitudinal incision the saw is applied as follows : when the circular layer of the cork has been removed from the tree to be stripped, it is cut from above downwards over successive lengths of 16 to 20 inches. In each of these lengths a first cut is made ¼ in. deep and the operation is repeated three or four times until the saw has entered the cork to the whole extent of the blade uncovered by the mounting. On completion of the incision the edge of the hatchet is run along it and it is prised apart every 12 inches until the ground is reached. The cork comes away perfectly with little or no loss and in slabs with regular edges.

In Algeria trial has been made of a number of coatings to prevent the sudden evaporation of the sap of the bast layers exposed by the stripping. This evaporation results in the bast perishing by drought so that the next layer of cork will be covered with a sort of crust which depreciates it notably. Up to the present two coatings have been used on a basis of cowdung or gelatine, with results which though evident are insufficient. The best results were obtained by making the cork itself which had been detached serve as the covering ; but this reapplication on the other hand has many disadvantages. Consequently the search must be undertaken for an inexpensive coating which is sufficiently impermeable. Experiments

on this point are in progress at Réghaia. The Author advises the following formulae:

1. Resin 15 lbs., caustic soda 5 lbs., fish oil 1 qt.; boil for about two hours with 1 or 1 ½ gallon of water; then add the necessary quantity of water to obtain a homogeneous brown liquid. Make up to 50 gallons and apply with the sprayer.

2. Resin 5 lbs., crystallised soda 3 lbs.; heat until dissolution; add a very small quantity of water, then ½ lb. of coal tar or tar; dilute to 10 gallons.

The use of the sprayer seems preferable to that of the brush, which is more difficult to handle and produces less perfect work.

1542 - Pine Forests and Products in Spain.

HERVEY, H. (H. M.' s Consul). Report for the Year 1911 on the Trade of the Consular District of Bilbao. — *Diplomatic and Consular Reports, No. 4946 Annual Series, Spain*, pp. 15 - 16. London, 1912.

Information on the prospects of resin-production in Spain may be gained from the following useful data.

"The Union Resinera Española," a Bilbao firm, owning, on freehold and lease, many of the principal pine forests in Spain, report that, chiefly owing to a decrease in production in America and other countries, prices of resin and by-products have risen considerably during the last two years.

This Company controls 54 037 hectares (about 135 000 acres) of resin-producing pine forests.

Their production during 1910 amounted to:

	Metric Tons
Resin	15 235
Turpentine	4 728

Their sales during the same period aggregated as follows:

	Abroad Metric Tons	In the Peninsula Metric Tons
Resin	8 918	7 413
Turpentine	4 26	705

The total outstanding capital of this company comprises:

	Pesetas
Shares	20 000 000
Debentures	11 002 500
Total	31 002 500

Equivalent in sterling £1 148 240.

The net profits, as per balance sheet dated June, 1911, amounted to 3 050 099 pesetas (£112 966), of which nearly two-thirds were laid aside to augment reserves, including a special fund to provide for the regulation of future dividends.

LIVE-STOCK AND BREEDING

HYGIENE

1543 - **The Poisoning of a Herd of Cows by Chemical Fertilizers in Carinthia, Austria.**

Eine Massenviehvergiftung durch Kunstdünger. — *Wiener landwirtschaftliche Zeitung*, Year 62, No. 69, p. 810. Wien, August 28, 1912.

On the peat moors of Thonn-Tainach near Grafenstein in Carinthia experiments are being at present made with chemical fertilizers for the purpose of demonstrating to those interested the improvement produced by these manures, and especially the manner in which poor pastures are thereby converted into rich meadows. Amongst others, an area of 7½ acres was manured in the middle of August at the rate of 4 cwt. of basic slag and 3¼ cwt. of 40 per cent. potash salts per acre. As the soil was poor in nitrogen, an experiment was also made to ascertain the action of nitrate of soda. One plot of 2½ acres without nitrogen acted as a control; another 2½ acres was given 1½cwt. of nitrate and the third plot 3¼ cwt. While this fertilizer was being spread, rain began to fall; it continued to increase in heaviness and thus brought about the speedy solution of the soluble salts. The spreading of the manure was finished in the afternoon. As soon as the operation was concluded, 50 to 60 head of cattle, which were grazing and not under supervision, strayed on to the recently manured land to graze there and thus swallowed large quantities of the salt solution together with the grass. At nightfall, the animals returned to their stalls. About 11 p. m., a heifer appeared very unwell and shortly after died. On immediately making a round of the shed, two cows were found lying down dead, but having manifested no previous alarming symptoms. During the night, 11 head of cattle in two other sheds also succumbed, or at least had to be slaughtered.

Altogether, 20 animals were affected, of which some were saved by injections of camphor administered by the vet to relieve heart weakness. The autopsy of the dead cattle, which was carried out next day by the veterinary inspector Hr. Schwaml, revealed a poisoning by the soluble fertilizers of which the most conspicuous symptom was a corrosion of the mucous lining of the stomach. The official report of the post-mortem, which has not yet been published, will probably give more precise details of the

different causes of death. The carcasses of the animals were much inflated, and decomposed with extraordinary rapidity, having to be destroyed with the exception of the skins.

Cases of wholesale poisoning by means of chemical fertilizers, though sporadic, are especially to be feared on Alpine pastures where the cattle graze in spring immediately after the manure has been spread. It would be worth while collecting all the practical observations made on this subject, which are of great interest.

1544 – The Dosing of Sheep with Cooper's Dip and Bluestone against Intestinal Worms.

THEILER, ARNOLD. Experiments to determine the Safe Dose of White Arsenic, Cooper's Dip and Bluestone for Sheep. — *The Agricultural Journal of the Union of South Africa*, Vol. III, No. 3, pp. 321-351. Pretoria, March 1912.

THEILER, ARNOLD. Interim Report *re* the Dosing of Sheep with Cooper's Dip and Bluestone under the Conditions of a Sourveld Farm. — *Ibid.*, Vol. IV, No. 2, pp. 161-171. Pretoria, August 1912.

The first series of experiments was undertaken to find out the maximum dose of a mixture consisting of equal quantities of bluestone and Cooper's dip, in dry powder form, which could be given against wire-worms and tape-worms to a number of sheep ageing from two-tooth upwards without risk of mortality. Cooper's dip is a proprietary drug, the composition of which has, to the writer's knowledge, never been published by the manufacturer. Its chief constituents are, however, arsenic combined with sulphur and alkalies, the arsenic being probably present in the form of soluble compounds such as sodium arsenite and sulph-arsenite.

From the results of the first series of experiments the writer concluded that a maximal dose of 15 grains of bluestone and 15 grains of Cooper's dip could be considered to be a safe one. In another series of experiments it was shown that when, to a safe dose of these drugs, such non-poisonous materials as salt and sulphur were added in equal parts, the otherwise safe dose caused death.

It was then concluded that the safe maximal dose could not be recommended indiscriminately, because it was thought that in practice the local conditions on the different farms might influence the toxicity of the safe dose just as the addition of the harmless substance had done.

A farmer in the Stutterheim District used the dose alluded to, the result being somewhat disastrous, as a number of sheep died from poisoning. The mortality however, only occurred amongst the two tooth sheep, and not amongst older ones.

As the opportunity had offered itself to the writer to repeat the experiment under the conditions of the sour veld, full advantage was taken to find out the maximal dose for the two-tooth sheep as well as for lambs. The results were as follows: —

The maximal safe dose for sheep of four to eight tooth under the conditions of the sour veld in Stutterheim district was found to be 15 grains of Cooper's dip and 15 grains of bluestone.

The maximal safe dose for sheep of two tooth under the same conditions proved to be 10 grains of Cooper's dip and 10 grains of bluestone.

The maximal safe dose for lambs between five and nine months old under the same conditions proved to be 7 ½ grains of each.

Smaller doses than the maximal ones proved to be equally effective on the wire worms (*Strongylus contortus*) as the maximal safe dose. (This, however, requires further investigation on a much larger number of sheep and lambs). The mixture of Cooper's dip and bluestone, even in the maximal doses, does not expel all worms, although it reduces their number.

Recommendation. — As a medium dose the following can be recommended: —

Sheep of four to eight tooth: 10 grains of Cooper's dip and 10 grains of bluestone.

Sheep of two tooth: 7 grains of Cooper's dip and 7 grains of bluestone.

Lambs of six to nine months: 5 grains of Cooper's dip and 5 grains of bluestone.

FEEDS AND FEEDING

1545 – The Composition and Value of Wheat Siftings ("Kriblon") as a Feed.

KLING, M. Über die Zusammensetzung und den Wert von Weizenausputz, sogen. Kriblon, als Futtermittel. — *Die Landwirtschaftlichen Versuchs-Stationen*, Vol. LXXVIII, Parts III and IV. September 30, 1912. Berlin.

In the districts of Kaiserslautern and Homburg in the Palatinate, the so-called "kriblon" (sometimes also designated "kriplo") is used in large quantities as a feed. The word "kriblon" is of French origin and is derived from "criblure" (siftings). "Kriblon" is the siftings from East European, usually South Russian, wheats and consists of broken and small wheat grains, various weed seeds, and larger or smaller quantities of inorganic impurities.

The "kriblon" wheat siftings on the market in the Palatinate were examined in 1907 and 1908 by the "Kgl. Agricultur-botanische Anstalt" in Munich and had the following composition:

	1907 Examination.
76.8 %	fragments of wheat.
22.0 %	whole weed seeds.
1.2 %	small stones and soil particles.
Total 100.0 %	

1908 Examination.

83.8 %	whole weed seeds, including 71.6 % seeds of black bindweed (*Polygonum Convolvulus* L.)
16.2 %	fragments of wheat (including a little rye).
Total 100.0 %	

Five samples of uncrushed "kriblon" from East European countries (South Russia), which were examined by the writer in 1910, contained on an average:

Composition	Minimum %	Maximum %	Average %
Fragments of wheat, etc.	29.2	81.8	50.5
Whole weed seeds	17.5	56.0	43.9
Inorganic impurities	0.5	14.8	5.6
Total	—	—	100.0

The weed seeds were chiefly black bindweed (*Polygonum Convolvulus* L.), while those of corncockle (*Lychnis Githago*), charlock (*Sinapis arvensis* L.) and *Saponaria Vaccaria* were present in considerable quantities.

This miller's waste was sold on the Exchange of Kaiserslautern at from 9 to 12 marks per 100 kg. (4*s.* 6*d.* to 6*s.* per cwt.), and brought in waggons to that district by means of agents and dealers to be fed (after crushing in the local mills) liberally to milch cows especially. For the crushing usually 70 pf. per 100 kg. (4*d.* per cwt.) was paid in addition.

According to Horneber, in the cow-houses of the district of Kaiserslautern often 2 cwt. of this crushed "kriblon" are fed to 12 to 15 cows per day.

The effect of this feed seems to be excellent; it is said to promote milk secretion, but the complaint is often heard that after being fed on this "kriblon" the animals fall ill, and even die, while abortion is very frequent.

The feeding value of crushed "kriblon" is very variable. In the first place, its value depends on the amount of broken wheat, small wheat grains, etc., it contains; this appears, according to the samples examined, to vary from 29.2 to 81.8 %. Most of the weed seeds are of equal nutritive value with the cereal seeds, as is proved by analysis, but the presence of many seeds is open to objections. The seeds of corncockle, for instance, are a feed of doubtful nature, although many investigators deny that they are injurious. Also many vetch seeds — those of *Vicia sepium* L. and *Vicia angustifolia* All., which occur in "kriblon," contain a poison, and form with water the dangerous hydrocyanic acid. Further, the writer has found the occasional presence of other poisonous seeds in "kriblon," *viz.* henbane (*Hyoscyamus niger* L.), spurge (*Euphorbia* sp.), darnel (*Lo-*

lium temulentum L.). Finally, the value of "kriblon" depends also on the percentage of inorganic impurities it contains. The content of these substances varies according to the writer's observations, between 0.5 and 17.8 per cent.

The very different results obtained from feeding on "kriblon" are quite in accordance with those given by these investigations. Crushed "kriblon" may be a good and useful feed; it may, however, be directly injurious to cattle according to its composition.

The writer therefore recommends that attention should be paid to the following points when buying or using "kriblon" as a feed:

1. The greatest care is recommended in purchasing "kriblon." It is best to buy it uncrushed and to choose only the best kind, which has been sieved to free it from earthy particles and small weed seeds.

2. The inferior kind, which contains much organic impurity and many weed seeds of doubtful nature, should not be used as a feed.

3. It is advisable to send a sample each time to be examined and approved by the nearest Agricultural Experiment Station.

4. The "kriblon" should only be employed crushed; if possible, it should be steeped in hot water or boiled before being fed.

5. Young animals and those in calf must only be given small quantities of "kriblon"; it is however best for them to have none.

6. Should any of the animals fed on "kriblon" show signs of illness, this substance should at once be dropped out of the ration.

BREEDING

1546 – In-breeding Experiments with Four-Horned Goats.

MÜLLER, R. Inzuchtversuch mit vierhörnigen Ziegen. — *Zeitschrift für Induktive Abstammungs-und Vererbungslehre*, VIII, Parts 3 and 4, pp. 240-251. Berlin, September 1912.

It is an axiom with biologists, doctors and breeders alike, that in-breeding leads to an accumulation of characters, which again finds its expression in an increased tendency to the development of the said characters. The writer has tried to solve this problem which has latcly been much disputed. He emphasizes as a first principle, that biological experiment must be directed to this end. On the one hand, the higher mammals should be selected for experiment more than has hitherto been done, and on the other, suitable characters should be sought for in sound animals in order to test their inheritance. Morphological characters should always have the preference in this connection over physical, as the latter are usually composed of a larger complex of qualities, the inter-relation of which it is impossible to estimate. Further, the morphological characters which are most suitable to use in inheritance experiments are those which can be measured, weighed or counted.

For this reason, the writer considers four-horned goats as especially favourable subjects of experiment. The occurrence of extra horns, which

is frequent in sheep, is not rare in goats. Nothing very definite can be affirmed respecting the origin of this characteristic, but the writer believes that the in-breeding of the products of crossing is favourable to the appearance of such a mutation.

In the experiments of the writer with four-horned goats he aimed chiefly at ascertaining two points:

1) how far the possession of four horns is hereditay according to the laws of Mendel, and 2) whether in-breeding causes an increase in the number of horns.

The solution of the second problem seems to the writer to be of great theoretical importance, since as far as he knows, no experimental proof has hitherto been obtained of the fact that in-breeding actually increases a characteristic. Such a proof is of much interest in regard to the whole question of inheritance and also because it would show that the inheritance of acquired characters is best brought about by means of in-breeding.

The subject of the experiment was an eight-year-old goat bred by in-breeding from products of crossing. The animal was grey and had four separate, well-developed horns, which in position, direction and development were independent of one another. It was served by an unknown two-horned male, presumably of a fawn-colour, and gave birth to three kids, two females and one male. Of the offspring, one male and one female had four horns and the other female two. Close in-breeding (of the first and second degrees) was continued and the following matings effected.

The brother with four horns (these coalesced into two very stout horns) was twice mated with his sisters. The result of his first mating with his two-horned sister was a four-horned male kid, and that of the mating with the four-horned sister was a four-horned female kid. On pairing the same animal a second time with his two-horned sister, the result was a male kid with six horny protuberances (of which two coalesced shortly after birth) and a four-horned, or rather five-horned (as one of the horns was divided) female kid. The offspring of the second mating with his four-horned sister were males, one two-horned and one four-horned.

Then the male with the very stout horns was mated with his mother. The first time a two-horned female and two four-horned males were dropped; the second mating resulted in four males, two with two and two with four horn-bumps.

The in-breeding of four-horned goats thus gave rise in the F_2 generation to an increase in horns, as is especially clearly shown in the case of the male kid with six horn-bumps, of which two coalesced shortly after birth.

The change in the shape of the skull caused by in-breeding is especially noticeable. While the forehead became broad and high, the lower part of the skull became short and narrow. The rudiments of the horns

are distinguishable immediately on birth by a thickening of the skin, which covers bony knobs scarcely to be detected by feeling.

The question how far the production of extra horns follows Mendelian laws cannot be determined accurately owing to the few generations hitherto obtained by the writer. So much only can be said that the possession of four horns is at least as much inherited as that of two. The proportion of two-horned to four-horned animals is 1 :1 or 1 :2.

The writer also hopes to prove by his experiments, that the tendency of the rudimentary horns to coalesce is inherited.

Close in-breeding, which consists in mating mother and son, has resulted already in the F_2 generation in the appearance of characteristics of in-breeding in the form of a weakening of the bony frame and reduction of the mass of muscles. It is also a result of in-breeding when a kid has lost the sucking instinct and has to be bottle-fed. In the case of two offspring (the progeny of father and daughter), want of vitality led to premature death. In another case the sucking instinct was so entirely lost, that the animal was unable to swallow the milk poured into its mouth. These extreme signs of in-breeding are probably to be explained by the fact, that the mother with whom the experiment commenced was weakened through previous in-breeding. This is the more likely, seeing that the animals were carefully reared, were given abundance of milk and sufficient exercise. Improper treatment of the animals can thus not be the cause of their defects.

The experiment, further, seems already to show that in-breeding, equally tends to encourage albinism and melanism, which is the view held also by Professor Adametz of Vienna (1).

In addition, it should be remarked that the possession of extra horns is correlated with a diminution in milk yield. The four-horned goats gave only 2 to 2 ½ pints a day.

The writers' experiment has fully justified the preliminary hypothesis, as is proved by the goat with the six rudimentary horns. He hopes that the continuation of his researches will give further results, which will throw light on the questions of inheritance and in-breeding.

1547 – The Mode of Inheritance of Fecundity in the Domestic Fowl.

PEARL, R. in *The Journal of Experimental Zoology*, Vol. 13, No. 2, pp. 153-268. Philadelphia, August 20, 1912.

During the course of an investigation into the inheritance of fecundity in the domestic fowl, whih has now involved thirteen generations and se-

(1) Die biologische und züchterische Bedeutung der Haustierfärbung. *Jahrbuch der Landw. Pflanzen- und Tierzüchtung*, II. Stuttgart, 1905.

TABLE I.

Case No.	Bird No.	Breed	Date of hatching	Date killed	Total number of eggs laid in life	Winter production	Discharged follicles	Oöcytes, 1 cm or over in diameter	Oöcytes, 1 mm. to 1 cm. in diameter	Oöcytes, under 1 mm. in diameter	Total visible Oöcytes
1	8021	Barred Plymouth-Rock . .	June 1, 1910 . . .	March 28, 1911 . .	10	3	17	9	53	1149	1228
2	8017	» » » . .	» 2, » . . .	» 30, » . .	10	0	12	7	51	1596	1666
3	8030	» » » . .	» 1, » . . .	» 10, » . .	7	0	8	5	62	839	914
4	8005	» » » . .	» 2, » . . .	» 14, » . .	17	5	12	8	68	1096	1174
5	1367	» » » . .	April 28, » . . .	April 4, » . .	34	3	49	7	29	2121	2306
6	8018	» » » . .	June 2, » . . .	March 24, » . .	16		23	6	42	1123	1194
7	8009	» » » . .	» 2, » . . .	» 24, » . .	15	0	17	6	49	2029	2101
8	8010	» » » . .	May 19, » . . .	» 17, » . .	19	5	24	5	92	1455	1576
9	425	» » » . .	March 30, 1909 . . .	July 7, 1910 . .	23	0	21	12	142	1346	1521
10	3546	White Leghorn (1)	May 18, » . . .	December 20, » . .	198	54	75	—	231	2146	2452
11	2067	» » (1)	» 28, » . . .	» 15, » . .	197	32	217	1	108	3279	3605
12	3453	» » (1)	» 21, » . . .	» 13, » . .	10	0	11	—	75	1626	1701
13	3833	» » (1)	June 14, » . . .	» 22, » . .	2	0	43	—	80	2022	2145
14	52	Cornish Ind. Game	April 21, » . . .	July 12, » . .	52	13	54	6	167	1323	1550
15	71	F_1 Cross	March 31, 1910 . . .	March 20, 1911 . .	124	106	50	5	70	1875	2000
16	—	Guinea hen	?	January » . .	?	—	9	3	36	717	765
17	—	Guinea hen	?	» » . .	?	—	—	3	38	545	586

(1) The egg records are not the records for life, but the records up to November 1, 1910. The figures represent practically the whole production.

veral thousand individuals, the writer has come to the two following definited and clear results:

First: That the record of egg production or fecundity * of a hen s not of itself a criterion of any value whatsoever from which to predict the probable egg production of her female progeny.

Second: That nevertheless, fecundity is in some manner or other inherited in the domestic fowl. This must clearly be so, because it has been possible to isolate strains of birds which breed true to definite degrees of fecundity. It remained thus to investigate the mechanism of this inheritance.

The fecundity in fowls depends undoubtedly upon two general factors:

1. Possession of an anatomically normal ovary.

2. Presence of that physiological factor or group of factors which ensures the normal activity of the ovary.

The first thing to investigate was whether the fecundity of a hen was influenced by the number of ova in the ovary. These were counted in a number of hens of which the exact number of eggs they had laid in the course of their lives was known. The data thus obtained are given in Table I.

The last column of the table shows that the oöcytes required for a very large production of eggs were present in all the hens, because a hen (at least of the American and Asiatic breeds) lays on average only about 400 to 500 eggs during its whole life. It is true, some 1000-egg hens have been recorded, but seldom.

Great fecundity must therefore depend upon other factors.

The writer assumes that in all hens there is a physiological factor involved in fecundity which he designates as the "normal ovulation" factor. It is this which determines in the existing anatomical basis (ovary) an activity, that is, the laying of eggs, about the same as that met with in the wild *Gallus bankiva* under normal circumstances. Under conditions of domesticity the activity of *only* this factor will mean the production of somewhat more eggs than under wild conditions. A still higher production of eggs is determined by a second physiological factor or complex of factors, which may be designated as the "excess production" factor ** in fecundity, and which, added to the existing first factor, only develops its full effect when the first physiological factor is present; failing this the second can only determine a medium production of eggs.

* Pearl suggests the term "fecundity" be used to designate the capacity of the individual to form germ cells, and not fertility proper which requires the cooperation of both sexes.

** As to the nature of this factor one can only speculate. Probably it involves more perfect metabolism or something of the kind. (*Author's note*).

For the representation of the various factors and their combinations several symbols are taken (according to the method generally followed at present in the designation of hereditary characters which segregate according to Mendel's laws.) Thus F denotes the presence of an ovary (female sex), F its absence (male sex). The first physiological factor for the production of eggs (*normal ovulation factor*) is represented by L_1 and the factor for specially high fecundity by L_2. The latter factor is considered as a sex-limited factor. Before the division of the sex-cells (zygotes) L_2 should be found in both male and female cells, but in the mature sex-cells (gametes), the combination FL_2 should not be possible; that is, when L_2 occurs in a mature female sex-cell, the combination of this cell with a sperm-cell can only give birth to a cock and never a hen (1). At the same time both male and female birds can have the factor L_2 but the former can have it twice, from both parents, while hens inherit it from only one, the father. Hens are always heterozygotic in respect of L_2.

The above theory is then more closely examined in the light of the results obtained by the writer in his breeding experiments, or rather it explains these results.

In these experiments, Barred Plymouth Rocks of a very good egg-laying strain and pure bred Cornish Indian Games, very poor egg layers, were used.

The possible combinations of the above named factors are given in Tables II to V for the male and female birds of both breeds.

TABLE II.

Constitution of Barred Plymouth Rock males in respect to fecundity.

Class	Zygote	Gametes produced
1	$f\ L_1\ L_2$. $f\ L_1\ L_2$	$f\ L_1\ L_2$
2	$f\ L_1\ L_2$. $f\ L_1\ l_2$	$f\ L_1\ L_2$, $f\ L_1\ l_2$
3	$f\ L_1\ L_2$. $f\ l_1\ L_2$	$f\ L_1\ L_2$, $f\ l_1\ L_2$
4	$f\ L_1\ L_2$. $f\ l_1\ l_2$	$f\ L_1\ L_2$, $f\ L_1\ l_2$, $f\ l_1\ L_2$, $f\ l_1\ l_2$
5	$f\ L_1\ l_2$. $f\ L_1\ l_2$	$f\ L_1\ l_2$
6	$f\ L_1\ l_2$. $f\ l_1\ l_2$	$f\ L_1\ l_2$, $f\ l_1\ l_2$
7	$f\ l_1\ L_2$. $f\ l_1\ L_2$	$f\ l_1\ L_2$
8	$f\ l_1\ L_2$. $f\ l_1\ l_2$	$f\ l_1\ L_2$, $f\ l_1\ l_2$
9	$f\ l_1\ l_2$. $f\ l_1\ l_2$	$f\ l_1\ l_2$

(1) This theory is based upon experiments made for the study of inheritance of colour pattern in poultry, and which prove that these conditions prevail. (*Author's note.*)

TABLE III.

Constitution of Barred Plymouth Rock females in respect to fecundity.

Class	Zygote	*f* - bearing (♂ producing) gametes	*F* - bearing (♀ producing) gametes	Probable winter egg production of ♀ of indicated zygotic constitution.
1. . . .	*f* L_1 L_2. *F* l_1 l_2	*f* L_1 L_2, *f* l_1 L_2	*F* l_1 l_2, *F* L_1 l_2	Over 30 eggs (*)
2. . . .	*f* L_1 L_2. *F* L_1 l_2	*f* L_1 L_2	*F* L_1 l_2	» 30 »
3. . . .	*f* L_1 l_2. *F* l_1 l_2	*f* L_1 l_2, *f* l_1 l_2	*F* l_1 l_2, *F* L_1 l_2	Under 30 eggs
4. . . .	*f* L_1 l_2. *F* L_1 l_2	*f* L_1 l_2	*F* L_1 l_2	» 30 »
5. . . .	*f* l_1 l_2. *F* l_1 l_2	*f* l_1 l_2	*F* l_1 l_2	Zero eggs
6. . . .	*f* l_1 L_2. *F* l_1 l_2	*f* l_1 L_2	*F* l_1 l_2	Under 30 eggs

(*) See foot note, Table V.

TABLE IV.

Constitution of Cornish Indian Game males in respect to fecundity.

Class	Zygote	Gametes produced
1	*f* L_1 l_2. *f* L_1 l_2	*f* L_1 l_2
2	*f* L_1 l_2. *f* l_1 l_2	*f* L_1 l_2, *f* l_1 l_2
3	*f* l_1 l_2. *f* l_1 l_2	*f* l_1 l_2

Both breeds were mated among themselves and reciprocally crossed; the cross breds F_1 and F_2 were mated among themselves and also with both parent breeds.

Since the actual breeding operations were carried out in advance of any understanding of the mechanism of the inheritance of fecundity, the matings were substantially at random so far as concerns fecundity factors. As a consequence not all gametic pairings have been made.

The results of the matings are given fully in tables. In all cases in which the result of the experiments did not turn out as was to be expected from the characters of the parents, an explanation has been sought.

Frequently the difficulty in this respect lies in the fact that some hens laid exactly 30 eggs or a trifle above or below this number. The author

TABLE V.

Constitution of Cornish Indian Game females in respect to fecundity.

Class	Zygote	f - bearing (♂ producing) gametes	F - bearing (♀ producing) gametes	Probable winter egg production ♀ of indicated zygotic constitution
1	$f L_1 l_2 \cdot F L_1 l_2$	$f L_1 l_2$	$F L_1 l_2$	Under 30 eggs (*)
2	$f l_1 l_2 \cdot F L_1 l_2$	$f l_1 l_2$, $f L_1 l_2$	$F L_1 l_2$, $F l_1 l_2$	» 30 »
3	$f L_1 l_2 \cdot F l_1 l_2$	$f L_1 l_2$, $f l_1 l_2$	$F l_1 l_2$, $F L_1 l_2$	» 30 »
4	$f l_1 l_2 \cdot F l_1 l_2$	$f l_1 l_2$	$F l_1 l_2$	— — —

*) As the best measure of fecundity the number of eggs produced in winter (autumn to March 1) was taken, and accordingly the hens were divided into three classes: good layers (over 30 eggs), medium layers (under 30 eggs) and poor layers (0 eggs).

points out also that it may happen that a hen belonging to the "over 30 eggs" class, owing to unfavourable exterior conditions such as retarded development while young consequent on late hatching, disease, etc., in reality lays somewhat less than 30 winter eggs. On the contrary very favourable conditions may cause a hen belonging to the "under 30 eggs" class to lay a few eggs above 30.

In such cases the 30 egg limit was somewhat raised or lowered according to prevailing circumstances.

The following are some extracts from the numerous tables given by the writer.

TABLE VI.

In the mating of Barred Plymouth Rock ♂ ♂ of class 4 (1) with ♀ ♀ of all classes the following ratio in regard to winter egg production in the female progeny is to be expected (*).

B. P. R. ♀ ♀ of class 4	Daughters with a winter production of over 30 eggs	Daughters with a winter production of under 30 eggs	Daughters with a winter production of zero eggs
1	3	4	1
2	2	2	—
3	3	4	1
4	2	2	—
5	1	2	1
6	1	2	1
♀ ♀ of all classes . . .	12	16	4
Ratio . . .	3	4	1

(1) See Table II.

(*) In the original paper there is a corresponding table for each class. (*Ed.*)

TABLE VII.

*Results of matings of Barred Plymouth Rock ♂♂ of class 4 with ♀♀ of class 1 - ($f L_1 L_2$. $f l_1 l_2 \times f L_1 L_2$. $F l_1 l_2$).**

Number of individuals involved		Winter egg production of daughters				
♂♂	♀♀	Class	Over 30	Under 30	Zero	Total adult ♀♀ progeny
4	17	Observed	21	30	8	59
—	—	*Expected* **	*22.1*	*29.5*	*7.4*	—
Mean winter egg production of all ♀♀ in indicated class . . .			48.85 eggs	16.34 eggs	0 eggs	—

(*) It would have been too laborious to study the germ cell constitution of the birds on the basis of the characters of both ther female *and* male progeny; consequently all conclusions in this regard are based upon the *study of the characters of the female progeny.*

(**) According to the ratio given in Table VI for the birds involved.

TABLE VIII

Results of winter egg production for all matings taken together.

Mating	Winter production of daughters			
	Class	Over 30	Under 30	Zero
All Barred Plymouth Rocks × B. P. R.	Observed	365.5 *	259.5	31
	Expected	*381.45*	*257.25*	*17.30*
All Cornish Indian Games × C. I. G.	Observed	2	23	15
	Expected	0	*25*	*15*
All F_1	Observed	36	79	8
	Expected	*26.5*	*86.75*	*9.75*
All F_2 and back-crossed **	Observed	57.5	98.5	23
	Expected	*68.60*	*95.00*	*15.40*

* Hens with exactly 30 eggs have been considered as belonging half to the first class and half to the second.

** With few exceptions.

The writer sums up the chief results of his researches as follows :

1. — The record of fecundity of a hen, taken by itself alone, gives no definite reliable indication as to the probable egg production of her daughters. Furthermore mass selection on the basis of fecundity records of females alone, even though long continued and stringent in character, gave no positive success.

2. — Fecundity must, however, be inherited. (Both these conclusions have been mentioned in the beginning of this paper and are to be found in previous writings of the author).

In the present paper it is further shown :

3. — The basis for observed variations in fecundity is not anatomical.

4. — This can only mean that observed differences (variations) in actual egg productions depend upon differences in the complex physiological mechanism concerned with the maturation of oöcytes and ovulation.

5. — The best available measure of innate capacity in respect of fecundity is afforded by the winter egg production of a hen.

6. — It is found that birds fall into three well-defined classes :

a) Hens with high winter records
b) » » low »
c) » » no »

The division point between *a*) and *b*) for the Barred Plymouth Rocks used in these experiments falls at a production of about 30 eggs.

7. — There is a definite segregation in the Mendelian sense of the female offspring in respect to these three fecundity divisions.

8. — High fecundity may be inherited by daughters from their male parent, independently of their female parent.

9. — High fecundity is not inherited by daughters from their female parent. This is proved by the following evidence : *a*) selection (see above) does not alter fecundity in any way ; *b*) the proportion of highly fecund daughters is the same whether the female parent is of high or low fecundity provided both are mated to the same male ; *c*) the daughters of a highly fecund hen may show either high or low fecundity, depending on their male parent ; *d*) the proportion of daughters of *low* fecundity is the same whether the female parent is of high or low fecundity provided both are mated to the same male.

10. — A low degree of fecundity may be inherited by the daughters from either male or female parent or from both.

11. — The results respecting fecundity and its inheritance stated in paragraphs 3 to 10 inclusive are equally true for Barred Plymouth Rocks, Cornish Indian Games, and all cross-bred combinations of these breeds in F_1 and F_2.

WORK OF LIVE STOCK ASSOCIATIONS AND OTHERS FOR THE ENCOURAGEMENT OF BREEDING.

1548 - **Cattle Shed Competitions Organised by the Ministry of Agriculture and of Public Works of Belgium.**

Concours d'étables organisés par le Ministère de l'Agriculture et des Travaux publics de Belgique. *Ministère de l'Agriculture et des Travaux publics. Bulletin de l'Agriculture et de l'Horticulture*, Second Year, No. 1, Vol. II, pp. 1-3. Bruxelles, 1912.

The following information is extracted from the circular of June 18th 1912 addressed by the Ministry of Agriculture and of Public Works to the State agricultural officials concerning the Cattle Shed Competitions organized by the above named Ministry.

Grants for shed competitions are made to Agricultural Associations, Unions of Breeders' Syndicates and committees formed of delegates of Unions for the Insurance of cattle and small stock. The latter may only give their official patronage to the competitions with which they are concerned. The grants to a competing farm may not exceed an average of 35 fr. (27*s* 8*d*.) for cattle sheds, 15 fr. (12*s*.) for piggeries and 12 fr. (9*s* 4d.) for goat sheds on obtaining 60 % of the points.

The special regulations of the competitions will be elaborated in conjunction with the State agricultural official of the District, who takes care that the regulations made are those most adapted to the needs of the several districts where the competitions are held.

The prizes will not be given in proportion to the expenses incurred by each competitor, but will be based entirely on the condition of the shed at the second visit of the judges.

When it is considered advisable, it can be laid down in the regulations that only such sheds shall be eligible for money prizes as are capable of considerable improvement. In this case, it will be necessary to define precisely what is meant by considerable improvement, having regard, not only to the necessary expenses, but also to the importance of the improvement from the hygienic stand point.

The judges are to employ a scale of points, which may be variable according to the local needs, and according to the importance of the defects to be remedied in each case. It is desirable that a certain number of points should be reserved for: *a*) the condition preceding the carrying ont of the improvements; *b*) the existence of a place for the provisional housing of newly-acquired animals or of those suspected for any reason of being attacked by infectious diseases; *c*) the precautionary measures for safe-guarding the health of persons obliged to live in the proximity of the animals. If the local circumstances require it, different scales of points can be employed in the same competition for competitors who are tenants and for those who are owners of the sheds.

The competitions will deal exclusively with the sheds and not with their position, or the animals in them, except in cases where this regulation would hinder the success of the competition. In apportioning the prizes

and points no account will be taken of the relative importance of the competing sheds; this is so as to avoid a small shed answering perfectly all hygienic requirements being placed lower than a large one less well-kept.

The above regulations come into force from the beginning of the year 1913.

1549 – The Production and Breeding of Heavy Horses in Lombardy. HORSES

CUGNINI, A. La produzione e l'allevamento del cavallo da tiro pesante in Lombardia. — *Annuario delle Istituzioni agrarie Dott. Andrea Ponti*, Vol. X, Rural Years 1909 - 1910 and 1910 - 1911, pp. 41 - 91. Milan, 1912.

According to the last official live-stock census, Lombardy occupies the leading place in Italy in point of number of horses to area and takes the second place for number of horses per hundred inhabitants.

On the 19th of March 1908 the eight provinces of Lombardy possessed 165 456 horses, divided as follows:

Colts and fillies under three years	15 815
Stallions	241
Brood mares	10 315
Working horses (entire and geldings)	88 651
Working mares	50 434

The number of mares covered by heavy stallions has shown continuous increase since 1908, in which year 7531 mares were covered by 127 of these stallions; in 1911 these figures were respectively 13 008 and 197.

The principal centres of production of the heavy draught horse are the provinces of Cremona and Brescia, where two-thirds of the State stallions are heavy animals, mostly Belgians.

The mares of Cremona are indigenous or imported. The former belong to the old Cremonese breed and have an average height of 15 to 16 hands, with broad fore head andstraight or slightly dished profile; the body is full and muscular; the chest deep; the dorso-lumbar region is mostly divided by a median furrow continuing over the croup, which is generally broader than it is long. The limbs are short but occasionally not sufficiently muscular.

There are but few mares which show clear traces of the use of Clydesdale stallions and few likewise are crossbreds of Boulonnais and Percherons.

Horses imported from abroad are distinguished into those from France and those from Belgium. The latter are beyond doubt preferable as regards their more harmonious and uniform general build, greater development of the muscular system and skeleton and well-shaped limbs.

The like subdivision may be made in respect to the Brescian mares.

The stallions, as has been said, are almost always Belgians; this year, of 202 State and approved stallions, 182 were Belgians.

Among the methods of breeding, crossing is most general; the native or imported mares are served by stallions of foreign breeds; to a certain extent Belgian mares are put to stallions of the same breed.

For breeding no great importance is attached to good selection of the brood mares, but this wrong standard of judgment is in part made up for by the careful selection of the Belgian stallion.

With regard to feeding, it should be observed that where the dairy industry is greatly developed, as for instance in Lower Lombardy, the best hay is reserved for the cows and the horses are not well fed. Their ration during the summer is of permanent or irrigated grassland, and in the winter consists chiefly of stubble and a little hay; rarely of oats or meal.

During the covering season the stallions are well fed and do not work; afterwards they are kept like the other horses and work several hours a day.

The foals are born from February to May and are weaned at 5 to 6 months; they are then fed like the mares. When about 20 months old they are broken in and trained for work. There are some breeders however who keep their horses much better, and secure good results from them.

The stables are for the most part old, and consequently leave much to be desired in ventilation and light. During the last few years new and very much better stables have been built.

The trade in heavy horses in Lombardy is especially represented by the purchase and sale of foals 6 to 10 months old. On the average the animals of about 6 months fetch £14 to £22, but £32 and £40 is paid for the best animals and those a few months older. The majority of the young horses are taken to the province of Mantua and then when two years old they are bought by the farmers in Upper Lombardy, who use them for not over-heavy work during two years and afterwards sell them to owners in industrial centres for the carriage of goods, or else to the farmers in the flat regions.

Considerable likewise is the importation of heavy horses, especially from Belgium, in consequence of subscriptions opened among farmers on the initiative of agricultural committees, travelling lecturers and live-stock societies. The prices usually vary between £28 and £36 but £80 and even more are paid for valuable animals.

Among the means of improvement in horse-breeding, the author puts forward in the first place the importation of heavy stallions of foreign breeds by the State or private persons. Although much has been said for and against the Belgian stallion, now, after a trial of about 25 years, the majority of breeders prefer this race to Percherons, Boulonnais,

Pinzgauer and Clydesdales. The Ministry of Agriculture promotes this movement by always increasing the number of Belgian stallions in the State stocks and gradually doing away with the Clydesdales.

The author thinks that this preference given to the Belgian stallion is justified, and explains the reasons, which are based on the growth, general build, habits, feeding, diseases and selling prices of the products hitherto obtained in Lombardy. He likewise records the beneficial action of agricultural and live-stock societies by means of the importation of good breeding mares from Belgium. There are also some stallion syndicates subsidised by the Government, and in the provinces of Cremona and Brescia studbooks are likewise kept. The above societies, assisted by the Government and other bodies, every year arrange shows with prizes in the principal centres of horse breeding.

The author concludes by saying that henceforward all discussion concerning the utility of the Belgian stallion for crossing with Cremonese mares is superfluous ; nevertheless the problem is not entirely solved : in addition to the proper selection of the stallion, good breeding mares must be chosen, and the foals must be rationally reared. These improvements will be more rapidly and more easily obtained if breeders extend the action of co-operation by an organic and uniform programme to be applied in all the centres of breeding of heavy draught horses.

This programme should specially consist in the following points :

a) Rational selection of breeding animals.

b) Establishment and proper keeping of stud books.

c) Rational rearing of the foals.

d) Prizes for keeping, to prevent the sale of the best specimens born in the region.

e) Zootechnical instruction of the breeders by lectures, popular publications, etc.

f) Periodical prize shows in the most important breeding centres.

1550 - **Cow Testing in the Breeding of Dairy Cattle** (1).

CATTLE

V. — **Results and Prospects of Cow-Testing.**

The majority of the Breeders' Associations (mentioned in the preceding *Bulletin*) have only begun their yearly milking and butter tests within the last ten years, so that it would be premature to say whether the production of milk and butter-fat has improved under the influence of testing, and of breeding on the basis of yield. Tests extending over shorter periods have certainly been made before the last decade, and according to the recent report of the Holstein-Friesian Breeders' Association (*Breeders' Gazette*, No. 24, 1912) an increase of yield has been recognized : seven years ago among the Holstein-Friesian cows there were

(1) See N. 1439 *B.* October 1912, (*Ed.*)

only two that, during the test, produced in seven consecutive days upwards of 24 lbs. of butter-fat. Today there are already 169 such cows. Conditions are somewhat different as regards the Cow-Testing Associations. Here also the tests extend mostly over a few generations (in the oldest Associations the maximum is seven generations), but the immediate object at which these Associations aim is the elimination from the herds of all inferior milk and butter producing cows, and of all those that do not fully utilise their feed, in order to increase their gross and net returns. And this result will doubtless soon be attained by the Cow-Testing Associations. A proof of this is afforded by the following table in which the results of all the Control Associations of the Swedish district of Malmöhus are set forth. (see table VI).

TABLE VI.

Results of the Control Stations of the district of Malmöhus.

Average Results per Cow.

Year	Number of members	Number of Cows	Food Units			Milk yield in kg.	Percentage of Butter-fat	For 1 kg. Butter kg. of milk required	Butter yield in kg.	100 Food units yielded	
			Concentrated	Other food	Total					kg. Milk	kg. Butter
1901-1902	227	10 960	705.3	1614.16	2320.0	2848.6	3.21	28.2	100.84	122.8	4.39
1902-1903	311	16 206	673.4	1601.7	2275.1	3113.5	3.25	27.9	111.50	136.9	4.90
1903-1904	626	22 336	702.5	1556.4	2258.9	3166.6	3.25	27.9	113.48	140.3	5.02
1904-1905	860	27 362	738.4	1542.1	2280.5	3216.9	3.24	28.0	114.67	141.1	5.03
1905-1906	1 050	30 018	746.2	1568.0	2314.3	3290.7	3.26	27.8	117.59	142.2	5.08
1906-1907	1 261	33 501	746.3	1654.0	2400.3	3377.1	3.23	28.1	120.60	142.7	5.02
1907-1908	1 590	38 257	692.5	1794.4	2486.9	3506.0	3.26	27.8	126.20	141.0	5.07
1908-1909	2 092	43 715	702.0	1761.1	2463.1	3452.6	3.27	27.7	124.32	140.2	5.05
1909-1910 (1)	2 398	47 658	707.8	1861.1	2423.9	3376.4	3.27	?	122.05	139.3	5.04
1910-1911 (1)	2 479	47 832	620.0	1702.6	2322.6	3501.4	3.22	?	124.30	150.8	5.35

(1) According to information by correspondence.

It is true that, as Friederiksen observes (*Deutsche Landw. Tierzucht*, Nos. 22 and 23, 1912) the comparison between the average yields of the year 1900 and those of 1910 is not absolutely reliable, because most of the herds which gave the averages for 1910 were not yet under control

in 1900. Still, there is no doubt that an increase of production has taken place, the value of which is far superior to the cost of control.

This appears also from the following table of the results obtained by the first Cow-Testing Association of the United States (Table VII). It deals with a number of cows but slightly superior in the year 1909 to that of the year 1906. Consequently the above-mentioned source of error is almost eliminated.

TABLE VII.

Newago County Control Association.

Average Results per Cow.

Year	Number of Cows	Quantity of Milk in lbs.	Butter-fat content	Butter-fat yield	Value of 1 lb. Butter-fat	Total value of Butter-fat	Cost of roughage	Cost of concentrateds	Total Cost of Feed	Gross Returns	Each $ of Food was paid by	Feed cost of 1 lb. Butter-fat	Feed cost of 100 lb. milk
		Lb.	%	Lb.	Cts.	Doll.	Doll.	Doll.	Doll.	Doll.	Doll.	Cts.	Cts.
1906	239	5336	4.04	215.0	23.3	57.20	20.92	8.36	29.28	20.99	1.72	13.6	55
1907	287	5467	4.02	219.7	29.1	63.83	24.88	12.54	36.42	27.43	1.75	16.6	67
1908	254	6007	4.21	252.8	27.3	68.99	25.60	14.07	39.66	29.33	1.74	15.7	66
1909	272	6170	4.28	264.5	31.2	82.43	27.04	14.95	41.99	40.44	1.96	15.9	68

Besides the elimination of poor milkers from the herd, the better feeding which generally accompanies milk testing has contributed also to the increase of yield. After some years that the Cow-Testing Associations have been at work only a slight increase in the average yield is possible by these means. Nevertheless the yield control cannot be dispensed with, because in every herd the old, failing cows must be replaced by young ones which, as regards milk and butter production, may be good or bad. (See Table VIII).

A new question, of interest both to Cow-Testing Associations and to milch-cow breeders, now arises: Is there the prospect that the continued selection of good milch cows (and bulls) for breeding purposes will gradually lead to an increased production of milk and butter in a whole breed.

According to Galton it is so. The individuals of all species vary in their characters around an average. In many individuals a character is developed in a greater or less degree them in the average of the species. The limits of variation in the progeny of extreme parents (that is those

either above or below the average) are somewhat narrower (Galtons' law of regression) but not much so ; in other words : the characters of the progeny can in their turn vary above or below the corresponding characters of their parents. If these parents are already above the average of the species, a portion of their progeny may possess some character in a still higher degree than their parents. The selection for breeding purposes of individuals with a certain highly developed character will, with time, raise the upper limit of variation, and at the same time the level of the average development of this character will be raised in the whole breed subjected to selection : Selection allows the further development (or if practised in the opposite direction, the regress) of a character.

Galton has represented statistically this law in connection with the stature of man. Davenport (Bibl. 81) (1) gives a similar table (by Rietz and Davenport) for the heredity of the character of butter-fat production in Holstein-Friesian cows ; this table (VIII) is based upon the entries in the Holstein-Friesian Advanced Register.

In the first column, all the cows, altogether 608, are grouped in classes according to the amount of butter-fat, 11 lbs. and upwards, that they yielded during the seven days test. In the columns 2 to 19 the offspring of these cows are entered also according to their seven days' record.

The table shows :

1. Dams of the same class produced a great variety of descendants. Thus the ninety-four 14-pound dams (row *e*) produced all classes of cows from 11-pound up to 24-pound, although the greatest number were 15-pound and 16-pound cows.

2. Cows of any given class may be produced by a great variety of dams. Thus the minety-three 16-pound cows (column 7) were produced by dams ranging from 11-pound up to 23-pound.

3. The average of all the offspring (15.316) is slightly below the average of the dams (15.368)

4. For all dams below the average of dams (15.368) the average of the offspring is above that of the dams ; but for dams above the average, the offspring is in general inferior to the parentage.

5. Dams of all classes produced some offspring that were inferior to themselves and others that were superior, and this is as true of dams below the average as of dams above the average.

6. Many exceptional cows were produced by average dams and inferior ones, but the *greatest proportion* of exceptional cows was produced by superior dams. (2)

(1) See the Bibliography given in the first part of this paper No. 1439, *B.* October, 1912

(2) The sires were throughout very good. (*Ed.*).

TABLE VIII.

OFFSPRING

DAMS	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	
	—	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	Number of Cows	Average yield(**)	a
	11	1	1	3	—	—	1	—	—	—	1	—	—	—	—	—	—	—	—	7	14.0	b
	12	3	8	18	14	12	8	3	3	—	—	—	1	—	—	—	—	—	—	70	14.2	c
	13	1	13	18	18	16	13	6	5	2	1	1	—	—	—	—	—	—	—	94	14.6	d
	14	3	12	8	14	16	16	11	2	1	7	2	—	1	1	—	—	—	—	94	15.3	e
	15	2	6	13	15	11	18	13	8	4	3	—	—	1	—	—	—	—	—	93	15.4	f
	16	1	9	11	11	11	11	4	5	3	3	1	—	—	—	—	—	—	—	70	15.0	g
	17	1	5	6	12	8	8	8	5	6	3	—	—	—	—	1	—	—	—	63	15.7	h
	18	1	—	3	8	3	2	3	2	2	—	—	—	—	1	—	—	—	—	25	15.5	i
	19	—	3	3	2	3	2	4	5	2	4	—	1	1	—	—	—	—	—	30	16.7	j
	20	1	1	1	4	7	5	6	3	—	—	1	—	—	—	—	—	—	1	30	16.0	k
	21	—	—	—	1	3	6	4	2	1	1	—	—	1	—	—	—	—	—	19	16.9	l
	22	—	—	—	—	—	2	1	1	2	—	—	—	2	—	—	—	—	—	9	19.1	m
	23	—	1	—	—	—	1	—	—	—	—	—	—	—	—	—	—	—	—	2	14.0	n
	24	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	o
	25	—	—	—	—	—	—	—	—	1	—	—	—	—	—	—	—	—	—	1	—	p
Number of Cows		14	59	84	99	90	93	63	41	24	23	6	2	6	2	1	—	—	1	608	—	r
Average yield (*)		14.5	14.6	14.3	15.0	15.2	15.5	16.2	16.3	17.3	16.0	16.5	15.5	18.8	16.0	17.0	—	—	20.0	—	—	s

General average of dams: 15.568; of offspring 15.316.

(*) Average production of dams. — (**) Average production of offspring (*Ed.*).

Although this table deals only with a selection of cows (11-pound and upward) and consequently an entire population, yet it is in harmony with Galtons law,

Johannsen (Bibl. 89), by means of experiments with beans and barley (1), was enabled to determine that certain physiological characters of these plants varied about an average ; he succeded, by selection, in further developing or in diminishing these characters, but only when be carried out the selection within a population. When on the contrary he took a plant from a population and submitted to selection its offspring produced by auto-fecundation — a pure line — the type of the pure line was no way changed. According to Johannsen selection can only serve to pick out *already existing types* from a population, a pure line is not changed by selection (at least not in a provable degree).

Selection experiments conducted at Svalöf gave the same result.

It must not however be forgotten that both in Johannsen's and in the Svalöf experiments only auto-fecundating plants were dealt with. But also in the sugar beet which is only fecundated by other pollen, according to De Vries (*Mutations Theorie*, 1901) it was not certain then (1901) whether after a selection carried on through 25 generations the upper limit of variation had been, to any extent, raised. Vilmorin obtained as early as 1853 beets with 21 per cent. of sugar. The average sugar contents of beets ranged then between 7 and 14 per cent. The great improvement of beets for sugar making which has now been attained must be recognized, but it is due to a more perfected method of selection (Polarisation) and not to a higher development of the character « sugar contents » in all beets. Withont selection, in a few generations, the headway made would be lost, because then beets with a low sugar content would multiply in the same way as those rich in sugar.

R. Pearl (Bibl. 85) began in 1898 at the Maine Experiment Station a series of selection experiments on poultry with the object of increasing the production of eggs.

Only the eggs of hens which in their pullet year had laid 200 and more eggs were incubated. After nine years of this selection work Pearl could only state that the average egg production of his hens had in no way increased ; in fact it had somewhat diminished, after which for a whole year the egg production of the selected hens was compared with that of non-selected hens and here also the average yield of eggs of the former was somewhat inferior to that of the latter.

(1) Since no essential difference exists, in the laws of heredity, between animals and plants. some examples from the vegetable kingdom are here given.

Nevertheless Pearl conducted further experiments (Bibl. 86); he supposed that the fecundity of hens was determined by several hereditable characters, which segregate according to Mendelian laws (1) In this investigation he crossed Barred Plymouth Rocks and Cornish Indian Games. The Plymouth Rocks that he employed belonged to a very good egg-laying strain, while the Cornish Indian Games were poor layers. The breeding birds were divided into classes according to the egg-laying character of their offspring; for each of these classes a « formula of heredity » was drawn up. In crossing both breeds, birds with various formulae were mated according to a plan, and thus among others a race of Indian Games was bred which possessed the same fecundity as the Barred Plymouth Rocks and which, on being further bred, constantly reproduced it. Another important result of Pearls' investigations is the discovery that certain cocks on being mated with hens of all classes produce an offspring possessing a high fecundity. All the experiments were carefully carried out, and they extended over several thousand individuals.

It is not impossible that the characters « Milk production » and perhaps also « Butter-fat contents » are hereditary according to Mendel's laws. Wilson (Bibl.87) has endeavoured to demonstrate it for milk production alone). He availed himself chiefly of the entries in the Danish and Irish herdbooks. He compared the milk production of a great number of cows with that of their offspring. As far as possible the results of the granddaughters and great-grand-daughters of these cows were used in the comparison. In further researches Wilson attempted to discover the influence of the sire on the milk production of his offspring. In all cases the milk yield of the cows was reduced to normal yields by taking into consideration the accompanying conditions such as duration of the lactation period, time of calving, age, etc. Wilson points out that in the cases mentioned the milk yield of a cow is either nearly the same as that of her dam, or *much* smaller or greater. He accordingly divides cows into good milkers (1000 to 1200 gallons per year), medium (750 to 950 gals), and poor (550 to 600 gals.) A comparison of the yields of the offspring of the same sire shows that here also great differences may occur: they may comprise poor, medium and good milkers.

From the foregoing, Wilson concludes that low milk yield and high yield are special characters; that in mating a bull possessing one of these characters with a cow possessing the other one an intermediate offspring (medium milk yield) results. The assumption that medium milkers are intermediate is corroborated by the observation that both good and poor milkers are met with in their offspring. On the other hand very good

(1) See also No. 1547 above (*Ed.*).

milkers (class 1000 to 1200 gals.) have no very poor milkers (550 to 600 gals) in their offspring and no poor milkers generate cows belonging to the 1000 to 1200 gallon class. The offspring always either completely resembles its dam, as to milk yield, or is intermediate.

The heredity of morphological characters is in general easier to study than the heredity of milk yield, which, as a physiological character, varies in different animals only in the degree of its development. At the same time it depends a good deal upon exterior conditions which in the individual life of a cow may act upon it in a positive or negative direction. Davenport, Pusch and Sanson (Bibl. 81, 77 and 80) point out that a heifer becomes a specially good milker when she is allowed to breed very young. In addition to this, feeding, the manner and frequency of milking the length of time elapsing beteween one pregnancy and the other, as well as eventual diseases, exert a great influence upon the milk yield of a cow. Exterior conditions have less influence upon the fat content of the milk and probably the heredity of butter-fat content is easier to investigate than milk yield.

Observations have already been recorded (see Richardsen: Die *Schwedische Rinderzucht* pp. 188-119. — Högström *Kungl. Landbrucks - Akademiens Handlinger och Tidskrift*, Ar 1912, pp. 135-176. Schrewe, *Jahrbuch der Deutschen Landw. - Gesellschaft.* Band 24, pp. 212-214), which prove that a bull can increase or diminish the butter-fat content in all his offspring.

Further and thorough research into all the questions here mentioned is of great practical importance and it is very desirable that Cow-Testing Associations should in future work together with Breeders' Associations to a greater extent than they have hitherto done, and that their extensive observations on the milk and butter-fat yield of the cows tested should be entered in the herdbooks. A special note in the herdbooks, or in an annexed register, following the example set by the American breeders' associations, on those bulls that have produced a number of very good cows, would be very useful, because *the surest guide in the valuation of a bull is his offspring.*

The richer the store of data thus collected the sooner will it be possible to study the processes of heredity and to render the results of these studies available in the general interest.

1551 – The "Panello Zuccherino" (Sugar Cake) in the Feeding of Dairy Cows.

CUGNINI ANTONIO. Il "Panello Zuccherino" nell'alimentazione delle vacche da latte. — *Annuario della Istituzione agraria Dott. Andrea Ponti*, Vol. X, Years 1909-10 and 1910-11, pp. 25-40. Milan, 1912.

This deals with a series of experiments carried out by the Author at the Zootechnical Institute of the Royal College of Zootechnics and Cheese Manufacture at Reggio Emilia.

Among the various industrial residues adapted for live stock feeding the sugar cake which the Italian Distilleries Society has recently put on the market is to be mentioned. The Author tried it in the feeding of dairy cows.

Composition of the sugar cake. This food is found to be made up of grape pomace meal, mixed with dry residues from the distillation of cereals and molasses in the B brand of cake, while in the A brand the residues are wanting.

The grape pomace meal is obtained by grinding the grape skins and seeds separated from the stalk after distillation and washing, and drying until about 10 % of moisture is left.

A reddish powder is thus produced; analysis by Professor Fascetti yielded the following results:

Water	10.44 %
Fat	7.26 %
Crude protein	10.93 %
Nitrogen free extract	26.40 %
Cellulose	37.37 %
Ash	7.26 %

By the addition of the residues from the distillation of cereals and molasses the composition of the food is found to be as follows:

Sugar cake	Nutritive principles			Albuminoid ratio	Commercial units (1)
	Protein	Fats	Nitrogen-free extract		
Brand *A.*	8.75	4.10	50.20	1 : 6.8	84 —
» *B.*	14.34	4.10	35 —	1 : 3.1	86.20

This feed is brown in colour and breaks up easily: it has a pleasant smell and a slightly sweetish taste.

(1) The commercial units are obtanied by multiplying the figures of the protein content by 3, those of the fat content by 2, and adding these products to the figure of the nitrogen free extract. (*Ed.*).

Description of the experiments. Six Simmenthal cows and four Schwyz cows in ordinary lactation were selected and divided into four groups, *viz.* two groups each of 3 Simmenthal cows and four groups of 2 Schwyz cows, endeavouring to form homogeneous groups as regards race, weight, age etc.

All the groups were housed in the same stable and from the 15th September to the 20th October received a proportional ration of forage containing hay from permanent grass-land, wheat straw, mangolds and maize cake. From the 20th to the 23rd October in groups 1 and 3 the maize cake was gradually replaced by the sugar cake; the other two groups remained as control groups continuing to receive the usual ration.

The effects of the sugar cake were observed during a period of about two months, *viz.* from the 5th November to the 31st December 1911. The rations were calculated according to Professor Mallèvre's tables on the composition of rations and they were maintained constant during the preparatory period and afterwards remained so only for the control groups, as already stated.

The substitution of the sugar cake for the maize cake was carried out in such a way that the rations in which the former entered did not cause any perceptible variation in the relations between the quantities of the different nutritive principles, nor yet in the aggregate contents of these principles expressed in the same physiological value for the production of heat. In the following table the rations administered to the animals of groups 1 and 3 given.

The rations were given in two portions, *viz.* at 6 a. m. and 5 p. m.

Observations on the quantity and quality of the milk. The cows of the four groups were thoroughly milked twice a day, at 6 a.m. and 5 p.m.; samples were taken at the times of milking and the morning and evening ones were then mixed. From these investigations it resulted that the cows of the first group (experimental) fell off in the quantity of milk when passing from the preparatory to the observation period, that is to say from the total average for the three animals of 73.90 lb. there was a drop to 49.95 lb. But a diminution was likewise observed in the cows of the second group (control), the average of 70lb. dropping to 45.37 lb. The same thing took place in the other two groups, in which there was a daily reduction of 21.80 and 54.37 lb. respectively, which suggests that the reduction of milk taking place in groups 1 and 3 cannot be put down to the effects of the sugar cake, because an almost equal reduction took place in the control animals which received the maize cake instead of the sugar cake.

With regard to the quality of the milk, nothing occurred which can be brought into any connection with the giving of the new forage.

Description of Groups	Feeds used to make up the rations				Digestible nutritive principles			Total of nutritive principles reduced to the same physiological value for the product. of heat. Nitrog. nib. + fats. x 2.44 + hydrocarbons.	Total dry substance	Nutritive value expressed as starch	Albuminoid ratio
	Natural grassland hay	Wheat straw	Mangolds	Sugar cake	Albuminoids (nitrogenous substances)	Fatty substances	Total N-free extract (hydrocarbons)				
	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	
Group I — Ginestra (Simmenthal)	22.0	5.5	44.1	4.4	2.87	0.701	17.079	21.660	32.692	14.689	1 : 6.54
Group I — Frine (Simmenthal)	24.3	5.7	55.9	4.4	3.15	0.747	18.975	23.948	35.898	16.270	1 : 6.6
Group I — Floraia (Simmenthal)	26.5	—	55.2	4.4	3.28	0.767	17.939	23.082	33.019	16.338	1 : 6.04
Group III — Schüller A. (Schwyz)	19.8	5.5	39.7	4.4	2.66	0.655	15.767	20.020	30.283	13.589	1 : 6.54
Group III — Rossana »	26.5	—	55.2	4.4	3.15	0.767	17.939	23.082	33.019	16.338	1 : 6.04

Observations on the live weight. All the subjects, with the exception of one, gained noticeably in weight from the beginning to the end of the experiment, and the Author is of opinion that this increase is not connected with the effects of the new feed because it took place pretty uniformly in all four groups, and also because it is due, partly at least, to the advance in gestation of the several cows.

General conclusions. The Author sums up his results as follows:

The substitution of sugar cake for maize cake was made without difficulties, because the cows ate it greedily from the first day and always remained in good health.

Feeding with sugar cake produced no injurious effect on milk production or weight of the animals.

With regard to the economic desirability of its use, it should be noted that sugar cake sells at 5*s* 2 $^{3}/_{4}$ *d.* per cwt., so that each commercial unit costs 1.3035 *d.* On the other hand, with the present average prices, the commercial unit in linseed cake, maize cake, "coarse meal", wheat bran and maize sharps is found to be 1.732, 1.484, 1.456, 1.798 and 1.732 pence respectively.

The rations made up of maize cake cost in groups 1 and 3, altogether, 6*s* 3½ *d.* and those constituted of sugar cake for the same animals cost an aggregate of 6*s* 1*d.* It follows that in the period of 69 days during which this latter cake was given to the five cows in milk instead of the maize cake, there was a total saving of 14 *s.* 3 ¼ *d.*

On the basis of the above observations the Author thinks the conclusion justified that when suitability of price allows, sugar cake brand B may usefully be fed to cows in milk.

PIGS

1552 – **Fattening Pigs.**

WILSON, JAMES W. in *Agricultural Experiment Station, South Dakota State College of Agriculture and Mechanical Arts and Department of Animal Husbandry, Bulletin* No. 136, pp. 339-350. Brooking. South Dakota, 1912.

The results of two experiments are contained herein: 1) To determine the comparative value of buttermilk, sweet skim milk and sour skim milk when fed in conjunction with corn. 2) To determine the practical value of the "Hog motor", a machine so constructed with a pair of burrs that the hog is compelled to grind all the grain before he receives it.

Experiment No. 1. — This included a period of 62 days each in the summers of 1910 and 1911. The pigs consisted of pure-bred Poland-Chinas, Duroc-Jerseys, Berkshires, Hampshires and grade Duroc-Jerseys. Each year the 24 head were divided into lots of 6 each, as equal as was

TABLE I.

	1910 Experiment			1911 Experiment		
	Weight at beginning	Weight at close	Gain	Weight beginning	Weight at close	Gain
	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.
Shelled Corn:						
Weight of 6 pigs	519	925	406	598	959	361
Averages	86	154	68	98	159	61
Shelled Corn and Sweet Skim Milk:						
Weight of 6 pigs	546	1 162	616	560	1 171	611
Averages	91	193	102	93	194	101
Shelled Corn and Sour Skim Milk:						
Weight of 6 pigs . . .	589	1 181	592	537	1 166	629
Averages	98	196	98	89	194	105
Shelled Corn and Butter Milk:						
Weight of 6 pigs	552	1 157	605	563	1 191	628
Averages	92	193	101	93	198	105

possible, and placed in small lots in which there was an abundance of blue-grass pasture. In the 1910 experiment an average of about 2 ½ lbs. of milk was fed for every pound of shelled corn. In the 1911 experiment an average of about 3lbs. of milk was fed for every pound of shelled corn. Each year a lot was fed on shelled corn without milk as a check lot. The pigs were weighed every thirty days. The results are summarized in table No. 1.

It will be seen by this table that when milk was fed with the corn and grass, the pigs weighing between 80 and 100 lbs. more than doubled their original weights in two months' feeding, but where no milk was fed the original weight was not gained during this time. One pig in the sweet skim milk lot of the 1911 experiment made an average gain of 2 lbs, per day.

Table No. 2 includes the total number of pounds of feed fed, total gain, feed for pound of gain and the average gain per head daily for both experiments.

TABLE II.

Kind of Feed	Grain consumed	Gain	Milk consumed	Grain per 1 lb of gain	Milk for 1 lb. of gain	Average gain per head daily
	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.
Shelled corn	3 632	775	—	4.68	—	1.04
» » and sweet milk .	3 831	1 227	10 547	5.12	8.59	1.65
» » sour » . . .	3 889	1 221	10 656	3.18	8.72	1.64
» » buttermilk	3 889	1 233	10 656	3 15	8.64	1.66

The quantity of feed required for 1 lb. of gain with the lots that received milk is so nearly the same, that these feeds appear to be about equal for pig feeding. By feeding milk a larger quantity of grain was consumed by each lot. In fattening an animal, each feed that will increase the consumption of grain and hasten early maturity, providing the cost of such product is not prohibitive must be considered a benefit. Each bushel of corn fed without milk yielded an average of 11.9 lbs of pork. Each bushel of shellled corn fed with 153 lbs. of sour skim milk yielded an average of 17.6 lbs. of pork. Each bushel of shelled corn fed with 153 lbs. of buttermilk yielded an average of 17.7 lbs. of pork. These figures show that the 153 lbs. of milk increased the average gain of 5.8 lbs. of pork for every bushel of corn fed, so that this milk was equal to the amount of corn required to produce this gain in shelled corn lots, which in this case is about one half bushel. The grass pasture was a factor in these gains, as the pigs grazed during the evening and the cooler days.

Experiment No. 2. — In the fall of 1911 eight head of pigs averaging a trifle over 200 lbs. were divided into two lots of four each for the experiment. These pigs were placed in yards and had access to a good rape pasture. In one lot was placed the "hog Motor" filled with shelled corn and in the other lot was placed the self-feeder filled with corn meal. In a few days, when the pigs in the motor lot became acquainted with the machine and were working it successfully, the two lots were weighed up for the experiment and the grain weighed from then until the close of the experiment, which covered a period of 61 days. The corn for the self-feeder lot was ground to the same consistency as that ground by the motor lot.

The results of experiment 2 are summarized in table No. 3 and No. 4.

TABLE III.

	First weight	Second weight	Gain in 31 days	Final weight	Gain in second 30 days	Total gain	Average gain per head daily
	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.
Hog-Motor Lot:							
Weight of 4 pigs	813	1076	233	1206	120	363	—
Averages	210	269	58	301	30	91	1.40
Self-Feeder Lot;							
Weight of 4 pigs	937	1199	262	1318	119	381	—
Averages	234	299	65	329	30	95	1.56

The unusually cold weather in November when the thermometer registered at zero and below, is responsible for the small gains for each lot during the second thirty days of the experiment. These pigs were older and fatter at the beginning than those reported in experiment 1, and this is the reason why it required more pounds of grain for a pound of gain. From this the writer suggests that greater profit would be be made if hogs are fattened earlier and disposed of before danger of cold weather.

TABLE IV.

	Total grain consumed	Gain	Grain for 1 lb. of gain
	lbs.	lbs.	lbs.
Hog-Motor Lot	2047	363	5.63
Self-Feeder Lot	2180	381	5.72

Table No. 4 shows that the hogs eating meal from the self-feeder consumed 133 lbs. more during the 61 days and made 18 lbs. more gain

than did the lot doing their own grinding, but it required 0.09 more pounds of grain for 1lb. of gain with this lot than with the motor lot. The additional 18 lbs. of gain made by the self-feeder lot was made with 133 lbs. of gain and the cost of grinding the corn, while with the motor double the number of hogs could have worked the grinder. Each bushel of corn meal fed in the self feeder yielded an average of 9.79 lbs. of pork and each bushel of shelled corn fed in the "Hog-Motor" yielded an average of 9.94 lbs. of pork, a difference of 0.15 lbs. of pork in favor of the lot that did their own grinding. Every particle of grain that comes through the mill is eaten with no waste and the mill ought to last for several years. From these results the writer considers the "Hog-Motor" as a useful device in swine feeding.

1553 - **Methods of Promoting Laying from August to January.** POULTRY

LANGER, P. Aviculture. La ponte d'aout à janvier. — *Journal d'Agriculture Suisse*, Year XXXIV, No 30, pp. 261 and 264. Genève, July 23, 1912.

The writer recommends the following means for the prevention of the falling off in egg-laying from August to January.

In order to maintain the summer output of eggs, the hens must be given a plentiful supply of green food; cabbages, lettuces, spinach and chicory are all good, but sorrel is the best of all. Each hen should be given daily a good handful until the first cold sets in, when the amount of green food must be lessened in order to avoid cooling the fowls too much.

Then, to encourage moulting and hasten the winter laying season, a good deal of meat must be given, but overheating and diarrhœa should be guarded against.

After the middle of September, all the hens of two years old and over, which are no longer strong enough to produce the usual quantity of winter eggs, should be got rid of. Pullets are necessary for a succession of eggs in autumn and winter; these should be hatched in April, or bought on the market in June. If well fed and housed, they will certainly lay just when the other fowls leave off producing eggs. According to the writer, the breed is of little consequence; one poultry keeper will have remarkable results from a breed which is a failure in other hands. Without denying the winter laying qualities of Faverolles, Orpingtons and Coucous de Malines, the writer believes that the chief point is selection. The poultry keeper who for several consecutive years only sets the eggs of his best fowls will not fail to greatly improve his stock.

As an instance of this, the writer cites the case of 5 Buff Orpington pullets 6 months old, A, B, C, D, E, which gave the following number of eggs from November 1911 to May 1912.

Month	A	B	C	D	E	Total
Nov. 1911	18	17	—	—	—	35
Dec. » . . .	24	16	25	18	—	83
Jan. 1912 . . .	24	(broody)	27	13	14	78
Feb. » . . .	15 (broody)	11	24	25	27	102
March. » . . .	1	29	20	5 (broody)	22	77
April » . . .	24	2 (broody)	25	8	5	64
May. » . . .	12	5	(broody)	21	23	61
Eggs laid from Nov. to Jan. . .	66	33 + broody	52	31	14	196
Eggs laid from Nov. to May .	118	80	121	90	91	500

Summarizing, the writer concludes :

1. In order to get eggs in summer (apart from food, and the diet should be varied) it is necessary to destroy the vermin and give the fowls much green food and plenty of shade.

2. To obtain eggs in winter it is necessary to weed out all two-year old fowls, to house the birds well, and to obtain in good time a choice of pullets, about 50 % of the stock ; and in every case careful selection is needed.

3. The course of life in the poultry-yard in winter should be as even as possible ; any emotion, change of habits, introduction of strange birds into the run, may disturb the laying of the fowls.

1554 - Artificial Fattening of Young Pigeons.

GRITTON, A. Engraissement artificiel des pigeonneaux. — *La Vie à la Campagne*, Vol. XII, No. 143, pp. 150-153. Paris, September 1, 1912.

The artificial fattening of pigeons, which is usually not done by the breeders, in France forms a special industry worthy of mention. In order to realise its importance suffice it to say that enormous quantities of these birds are sold yearly in Paris and London. The world's consumption of pigeons is made up two thirds of Italian and one third of French and Belgian birds.

To make artificial fattening effetive the animals must be kept at rest in the dark and perfectly motionless. The temperature must be maintained at 18° to 20° C., with an atmosphere rather moist than dry. The fatting pigeons must be perfectly heathly, not too lean, and must be fed on healthy, nutritive and refreshing foods, not likely to impart a special taste or colour to the flesh.

Pigeon fattening may be carried on throughout the year, but the most suitable period is from May to July, when reproduction is more intense and the market demand greater owing to the absence of game.

It is impossible to fix with certainty the exact age at which pigeons may undergo fattening, but in principle it may be said that adult pigeons must always be rejected and those not yet fully grown chosen. The most suitable moment for beginning fattening is when the under-part of the wings commences to be covered with feathers and the wing and tail quills begin to appear clearly; this takes place between the twentieth and twenty-fifth day from hatching.

The basis of their food is in this case made up of Danube millet, which is supplied mingled with vetches, lentils, corn and rice. It is not advisable to use maize, buckwheat or flour balls. Millet constitutes three parts of this food, and the other fourth consists of one or several other seeds. French millet is likewise used, but it has the drawback of costing more than the other. The millet is soaked in water for 12 to 15 hours, the other grains are given dry.

The time required for fattening is from 2 to 5 days: in any case forced feeding must not be protracted beyond the sixth day, because after that limit the pigeon feels no effect from it. The opportune moment for discontinuing the process is when a little food still remains in the crop of the animal before feeding, which may easily be ascertained by feeling the crop.

The machines for cramming poultry are not adapted to pigeons, because meal is never administered to them, but seeds. There consequently only remains the really effective method of forced feeding done with the mouth by specially trained workmen. Their method is as follows.

Each feeder is assisted by a boy who hands up the pigeons to him one by one. He stands in front of the tub containing the grain mixed with water, takes the pigeon by the head in his left hand, holding the thumb and first finger on each side of the beak, while with the right he holds the claws and the wing tips. He then draws up into his mouth the quantity of food which he thinks necessary for the pigeon he has in hand, and with the two fingers opens its beak, and, making a complete contact between his mouth and that of the bird, forces the food into its throat, and then throws down the animal with a rapid movement into the basket, at the same time taking another pigeon from the boy. This operation is carried out rapidly, and a skilful workman can feed 800 pigeons per hour.

The pigeons which have received the food are kept in suitable superposed boxes in half-darkness. The animals intended for killing are fed lightly on the morning of their last day, and a few hours before killing they are made to drink about one-eighth of a pint of slightly salted water in order to whiten the flesh and give greater consistency to the fat. After drinking this water the young pigeons must be kept in a temperature of 25° to 30° C., in order that the above effect may take place.

Needless to say, the most scrupulous cleanliness must be observed throughout all the operations.

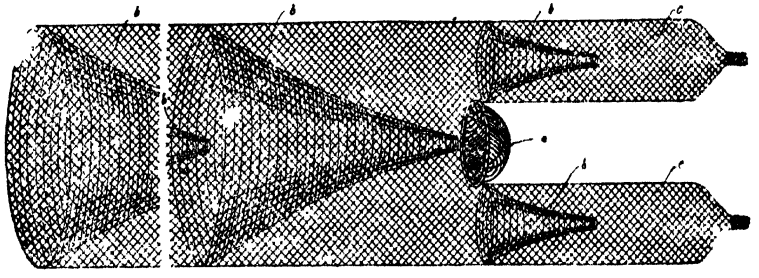
FISH

1555 - An Improved Drag-Net for Eels.

LINK. Eine verbesserte Form des Aalhamens. — *Mitteilungen des Fischerei Vereins für die Provinz Brandenburg*, Vol. IV (New Series), Part 7, p. 120. Berlin, October 1912.

The eel drag-net has become indispensable for river fishing. It has, however, the disadvantage that many young fish are caught in it and destroyed. This should be prevented by such a construction of the net as is shown in the accompanying figure. Instead of the usual central space, two side spaces, *cc*, are provided, into which the guiding funnels, *bb*, open. Between them is a basket, *a*, which allows the young fish to escape. This basket is made of parellel interlaced rods of aluminium, which are 11 mm. (nearly ½ in.) apart in the middle of the basket, and 10 mm. at the sides Thus the basket has perpendicular slits of 11 and 10 mm. in width through which the young fish which are caught can escape. The eels and all large fish soon find their way into the adjoining spaces, *cc*.

The perpendicular slits of the basket, which permit of the escape of the fishes, fulfil this purpose much better than square meshes. As the rods are of aluminium, the basket floats and thus does not drag along the bottom like the older apparatus of the same kind. Experimental tests of the new eel-net have proved that the escape-basket acts well.



FARM ENGINEERING.

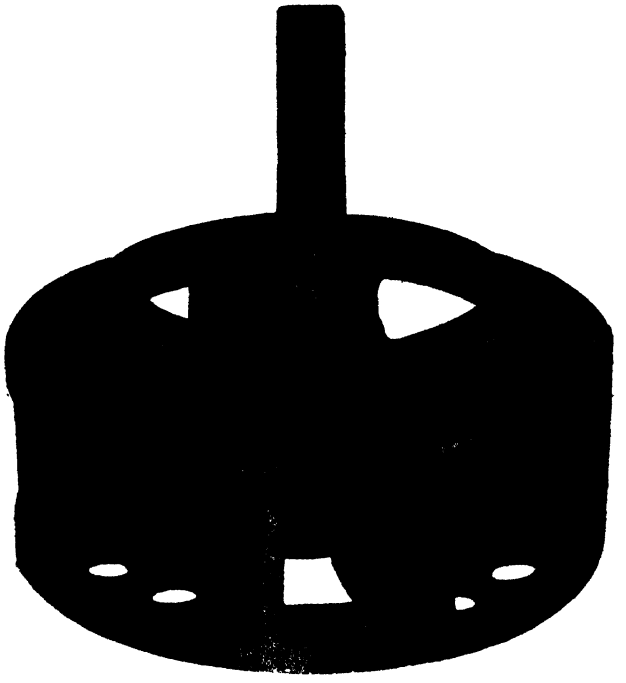
AGRICULTURAL MACHINERY AND IMPLEMENTS

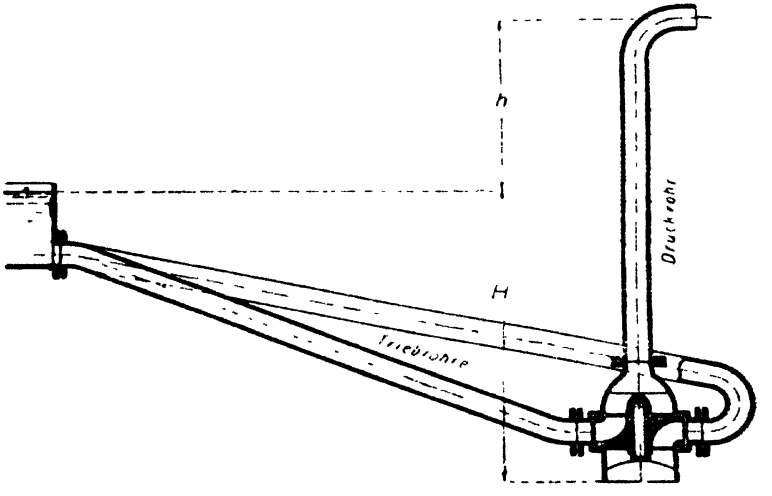
1556 - Methods of Water Supply and Drainage for Farms and Small Villages

PRUEFER, E. Wasserversorgungs und Entwasserungsanlagen für landw. Betriebe und kleine Dorfgemeindem. — *Maschinenzeitung*, Year 10, No. 19, pp. 221-226. Berlin, October 1, 1912.

Fig. I. represents the rotating wheel of the hydropulsator (1), which replaces the valve of the hydraulic ram. Fig. II is a diagram of a hydropulsator with two supply-pipes. As the wheel (Fig. I.) continually revolves

(1) See also No. 952, *B.* June 1912 for short description of this device. (*Ed.*).





11
Hydropulsator.

in the chamber shown below in Fig. II, more than two supply-pipes can be used and the performance of the hydropulsator thus increased.

On the Dretzel estate in the province of Saxony, a hydropulsator was used as a hydraulic machine for draining some meadow land. The available head of water was only 3 ft to 3ft 3 in; nevertheless the machine worked well; with a force of 4240 cub. ft. per hour, 2980 cub. ft. of water were raised over 3ft. 3 in.

RURAL ECONOMICS

RURAL ECONOMICS

1557 – **Grazing Farms and Hoed-Crop Farms; their Profits and Reciprocal Complementary Character.**

LANGENBECK, E. Weidewirtschaft und intensive Hackfruchtwirtschaft, ihre Einträglichkeit und ihre gegenseitige Ergänzung. — *Jahrbuch der Deutschen Landwirtschafts Gesellschaft*, Vol. 20, Part 2, pp. 452-483. Berlin, September 1, 1912.

In studying the problems connected with the organization of farms there is frequent occasion to recognise the fact that the personal capacity of the farmer has the greatest influence on the final profit of the undertaking. It must not however be forgotten that the special physiognomy of the economy of a given farm or of a given region cannot easily be eliminated, and that the capacity of the farmer consists precisely in wisely adapting his farm to these conditions of environment; because the different systems of management are only forms of adaptation of a farm to the natural and economic conditions which surround it. This intimate connection between the organization and management of farms and certain conditions of surroundings appears not only in the most various forms in the single details, but also in certain general lines and characteristic features commmon to farms which have arisen in similar conditions, and it is the systematic study of this connection which allows the fundamental problems of the organisation of a farm to be solved. The labours of the "Deutsche Landwirtschafts Gesellschaft" supply already sufficient material for a study of this kind and the writer extracts from it the data on the typical farms of the two economical forms which he studies.

He deals with 25 farms that grow sugar beets on upwards of 25 per cent of their acreage, with 17 farms based on intensive grazing (Fettweidewirtschaften) and 24 farms based on extensive grazing. The averages that are here given in Table I have been drawn from the figures given in Nos. 130, 180, 185, 186, 187 and 207 of the "Arbeiten der Deutschen Landwirtschafts Gesellschaft" and, for the fifteen extensive grazing farms of Eastern Prussia, from the statistics of the Insterburg Cooperative Bookkeeping Association (Buchführungs Genossenschaft Insterburg). Among

the grazing farms, a sharp distinction has been made between those in which grazing is carried on intensively and those organised on extensive lines.

The natural conditions for the first group are met with everywhere where the climate and the soil are favourable to grazing and where there is a good market for animal produce. If mountain farms are excluded, it will be found that in Germany the farms practising intensive grazing are met with in the most fertile parts of the plains.. The writer has chosen as typical representatives of this class of farms (Fettweidewirtschaft) 4 farms of the Dithmarschen district (Schleswig Holstein) and 13 of the Lower Rhine district. In both cases they are large farms conducted by peasants (grossbäuerliche Betriebe), but the economical views which direct the management of the live stock vary sensibly in the two groups. In the first. 80.1 per cent. of the acreage is occupied by meadows and pastures and only 18.7 per cent. by arable crops, of which 16.6 per cent. are forage plants. In the districts in which the pastures are richest, preferably store beasts are bought and fattened, and only a small number are kept during the winter. Notwithstanding the high prices paid for store animals, these farms, as is shown by Table I, yield a net revenue of £3 10*s* 8*d*. per acre, which represents 4.4 per cent. interest on the total value of the farm.

The farms of the Lower Rhine region do not attain such high returns. They are less favoured by nature; the area occupied by meadow and pasture is 64.2 per cent., while 32.5 per cent. is devoted to arable crops, of which only 15.5 per cent are forage crops. Fattening is here of secondary importance, the chief aim being the production and sale of high priced animals of good breeds. There is consequently no great difference between the number of animals kept during the summer and that during the winter. Thus the normal average number of head of live stock is 43.42 per 100 acres against 32.78 in the Dithmarschen farms. The arable crops and the meadows produce the forage required during the winter, besides which large quantities of concentrateds are purchased.

Thus also the extensive character of the Dithmarschen farms in regard to labour cannot be kept in these farms within the same limits; the extension given to arable crops brings the yearly labour bill to £1 4*s* 2*d* per acre against 13*s*. 11*d*. in the other farms. Evidently these intensive grazing farms should find it advantageous to diminish as much as possible their heavy outlay for the purchase of live stock, and this tendency is shown by the fact that in the Lower Rhine farms, pastures are continually encroaching on arable land. This change in the organization of the farms deserves to be taken into consideration also on account of the high price of labour, but nevertheless it ought not to exceed the limits necessary to ensure during the winter the forage required by a considerable number of head of live stock. According to the writer it is from these

farms based on intensive grazing that the country will draw the abundant and excellent supplies of animal produce that it requires.

Very different are the farms based on extensive grazing, which devote a considerable extent of land to forage crops. Table I shows clearly the fundamental differences between this group of farms and the two preceding groups in the distribution of their acreage.

TABLE I.

Average of	Area of meadow including permanent pasture	Arable area	Remaining area	Total area under cultivation	Total area under cultivation of which				Meadow, pasture and forage crops in % of the total cultivated area
					under meadow and permanent pasture		under forage crops		
	%	%	%	acres	acres	%	acres	%	%
13 farms based on grazing in the Lower Rhine region (Weidewirtschaft am Niederrhein)	64.2	32.5	3.3	198	124	62.6	11	5.6	68.2
4 farms based on intensive grazing in the Dithmarschen district (Fettweidewirtschaften in Dithmarschen)	80.1	18.7	1.2	217	180	83.9	4	1.8	85.7
9 farms based on extensive grazing (Extensive Weidewirtschaften)	38.0	59.2	2.8	881	378	43.0	121	13.7	56.7

These are, therefore, farms organized on the basis of forage crops (Feldgraswirtschaften), in which the fields sown to clover are mown during the first year and then left as pasture for some years. The chief aim of these farms is stock breeding, whilst fattening is of secondary importance and the production of milk is very limited. These farms also, under the influence of the present prices of produce and the dearness of labour, will tend towards a more extensive form of grazing, replacing the cultivation of forage crops by permanent pastures. There is no doubt that this transformation is taking place now more rapidly in those farms which are less advantageously situated.

Experts are of opinion that permanent pastures are successful not only where wheat and sugar beets give good results, but also in moist sandy soils on a subsoil rich in water, provided the rainfall be not less than about 12 inches between May and September. Wherever the forma-

tion of these pastures is possible from a technical point of view they are preferred to the growing of forage crops, because they give the most economical summer forage. The intensity of the rotation which will be introduced in substitution of the forage crop will be in harmony with the natural and economical conditions of the farm.

The value of these farms is respectively £26 4*s*. and £26 13*s* per acre (See Table II) ; it is low, both absolutely and relatively ; the quantity of live stock on the contrary is 20.92 normal head per 100 acres, or not much less than that of farms with intensive cultivation of sugar beets, which is 21.08. The net returns, 20*s*. 4 $^3/_4$ *d*. and 14*s*. per acre respectively, are low, but in the first case they are sufficient to pay the interest on the value of the farm.

It is difficult to say at present to what extent technical improvements and a judicious use of capital might increase the gross and net returns of these farms. There is, however, no doubt that they present a greater possibility of improvement than the intensive culture farms based on beets, which have already attained the limits of possible improvement and of intensity of culture. The great advantage of all these farms having large areas under forage is that of being extensive as regards labour and in a position to diminish the total demand for labour of German agriculture, and to free a certain amount of labour which may in its turn flow towards the more intensively cultivated farms.

The farms based on intensive grazing in the German plains, which are situated in favourable conditions of climate and locality, are on the contrary intensive as regards the capital employed, in which the ratio between income and expenditure in cash is most favourable ; high net returns are the result, which are after all necessary to compensate for high value of the farms.

If now the group of farms that cultivate beets intensively be examined, it will be seen that though in these farms high returns, with a relatively high net income, correspond to considerable outlay in cash, yet this net income does not pay to a really satisfactory extent the high total value of the farm. The ratio between the outlay in cash and the gross revenue in cash is not so good as in the intensive grazing farms ; and this is easily explined by the fact that in the latter the principal factor of production is Nature herself, who produces marvellously without requiring any great expense in labour or manuring ; on the other hand this ratio is better than in those farms which practise extensive grazing.

The writer examines minutely the economy of these groups of farms and especially of those that grow beets, with the object of showing the importance that they have in the national economy and to point out their complementary character as regards their labour requirements. Tables and diagrams show the ratio between the numbers of work days both of

TABLE II.

	25 farms of which upwards of 25 % of their area is under beets	Farms based on intensive grazing (Fettweidewirtschaften)		Farms based on extensive grazing	
		13 farms of the Lower Rhine	4 farms of the Dithmarschen	9 farms with 56.7 % of their area under forage production	15 farms of Eastern Prussia with 55 % of their area under forage production
Generalities.					
Distance from Railway . miles	1.3	2	3.4	5.4	—
Area of farm acres	1052	238	220	892	—
Capital invested per acre.	£ s.	£ s.	£ s.	£ s.	£ s.
Total value	100 17	77 11	79 8	26 4	26 13
Buildings	19 3	16 12	7 11	9 1	8 5
Machinery and implements . .	2 0	1 16	1 6	1 7	17
Live stock.	5 1	8 14	7 10	4 4	3 12
Live stock per 100 acres.					
Normal head of live stock. . .	21.08	43.4	32. 8	17.8	20.9
Unities of draught animals: 1 ox = $^2/_3$ horse	5.21	2.9	2.06	3.2	3.7
Percentage of total area:					
Meadow.	7.1	—	12.7	14.0	61.1 under forage production.
Meadow and permanent pasture	9.0	64.2	80.1	38.0	
Distribution of ploughed area					
Cereals. %	54.0	66.9	60.6	44.9	—
Beets »	29.4	—	—	0.3	—
Other hoed crops. »	9.3	16.4	9.0	11.4	—
Leaf plants. »	2.3	1.2	13.8	13.0	—
Forage crops »	5.0	15.5	16.6	30.4	—

TABLE II.

	25 farms of which upwards of 25 % of their area is under beets	Farms based on intensive grazing (Fettweidewirtschaften)		Farms based on extensive grazing	
		13 farms of the Lower Rhine	4 farms of the Dithmarschen	9 farms with 36.7 % of their area under forage production	15 farms of Eastern Prussia with 53 % of their area under forage production
Yield per acre.					
Wheat cwt.	23.72	19.82	15.13	18.04	—
Rye »	19.23	17.68	18.72	15.21	—
Barley »	21.36	21.27	32.10	17.95	—
Oats »	25.02	19.43	30.66	14.23	—
Beets »	270.91	—	—	—	—
Potatoes »	134.87	134.05	?	122.14	—
Returns in cash per acre of cultivated area.	£ s d 13 6 1	£ s d 7 7 9	£ s d 7 18 0	£ s d 4 6 10	£ s d 4 6 5
For produce of the soil. . . .	8 7 5	1 4 8	14 8	1 6 10	18 6
» » of live stock. . .	4 8 1	5 17 4	6 0 1	2 9 3	3 6 0
Sundries.	10 6	5 8	1 3 0	10 8	1 11
Outlay in cash per acre of cultivated area	10 8 4	4 18 4	5 7 0	3 8 8	3 12 1
For seed	3 1	1 2	1 1	2 10	2 8
For manure	1 1 1	3 3	2 8	4 0	4 1
For forage.	1 13 1	1 19 2	7 9	7 5	12 7
Outlay in cash per normal head of live stock	*6 13 3*	*4 4 0*	*1 3 10*	*2 0 1*	—
For live stock including draught animals	2 16 2	11 6	2 18 7	19 0	1 4 4
Wages and salaries.	3 2 6	1 4 3	13 11	16 5	16 1
Upkeep of buildings and implements.	16 8	9 7	3 2	9 5	5 4
Sundries	1 5 9	9 8	1 0 0	9 6	7 1

men and of animals per week and per 100 acres of area, required by each of these two groups of farms. The days' work of the animals are again divided into 6 groups : purchase and sale of produce, threshing, harvest, carting of manures, sowing operations, cultural and other work. From the whole of these data, which lend themselves well to analytical considerations, as well as to those of a general order, the writer considers himself justified in drawing some general principles which synthesize the numerous facts evidenced by the statistical data. The following is a brief résumé of these conclusions :

1. — Grazing is the basis of sound and lasting live-stock breeding.

2. — Wherever the climate and the soil allow of the formation of rich pastures, they are certainly advantageous owing to the present prices of live stock and in comparison with other systems of farming based on extensive employment of labour.

3. — In a farm in which beets occupy an important position in the rotation, intensive grazing is all the more advantageous the greater the returns of the pastures and the more unfavourable the conditions of the soil and of the crops. On the other hand, in farms where beets are intensively grown, grazing has no reason to exist.

4. — Hoed crops taken as a whole are the means of reaching a high level of farming, of obtaining a greater yield from the soil and a greater production of live stock. Hoed crops represent the highest degree of modern intensive farming and afford Germany the possibilty of producing the bread and meat she requires.

5. — The intensive cultivation of hoed plants must therefore be kept up on the areas that it now occupies wherever the locality and the natural conditions of the farm render it profitable.

6. — Grazing farms and intensive hoed crop farms should continue to complement each other as they have done in the past by a good division of labour.

What Assistance can Live-Stock Farmers expect from Book-keeping and Calculations.

FELBER, G. Welche Hilfe kann Züchter und Tierhalter von Buchführung und Calculation erwarten ? — *Arbeiten der Landwirtschaftskammer der Provinz Sachsen*, Part 3. Special Course on the Subject of Stockbreeding. Halle a. S., 1912.

To estimate correctly the special part played by book-keeping and calculations in stock farming we must clearly define the scope of their activity. Book-keeping and calculations can never take the place of knowledge of the principles of breeding and of the physiology of nutrition, for the quality of the product of breeding is entirely independent of the accuracy with which the books are kept, as the latter only serve to test the pecuniary advantages of breeding. For this purpose, a knowledge of

the cost of production of the results of breeding is necessary. No farm can be run for any length of time where the expenditure is not at least covered by the returns; and stock farming is no exception to this rule. The stock farmer must, in the first place, work with an eye on the market. The breeding of valuable animals, which will not fetch a sufficiently high price to cover the expenses incurred, will, in the end, in spite of brilliant success from the breeding standpoint, assuredly lead to agricultural ruin. Thus, the price likely to be obtained must at all events be sufficient to reimburse the outlay for the sire, attendance, food, buildings, etc. An accurate knowledge of the cost of production is thus an indispensable qualification.

The writer gives the following data from the accounts of a cattle-farm to explain the principles of book-keeping mentioned above.

The farm taken as an example is in the Province of Saxony, and the soil is good and highly cultivated. The milk is made into butter on the premises as there is no good local market for it.

The cattle consisted, taking the average for the year, of 0.8 head of bulls, 0.8 fatting beasts, 24.0 milch cows, 25.4 young cattle, 1.3 calves.

The net returns were:

	£	s.	d.
for cattle sold	434	19	4
for milk, butter etc.	390	0	0
Total	£824	19	4

The expenditure to be balanced with these returns was:

	£	s.	d.
for purchase of cattle	283	16	8
for vet, drugs, insurance of cattle for slaughter, control and breeding society, etc.	13	7	5
milking expenses	1	1	11
purchase of food stuffs	265	18	5
Total	£ 564	4	5

The calculation as to the net returns and expenditure in the keeping of milch cows allows of no possibility of error. The difficulties in calculation lie rather in the general and particular apportioning of the expenses of buildings, implements, the labour of men and animals, and especially in judging the amount and price of home-grown products which are consumed on the farm itself.

In the case under discussion, in addition to the net returns mentioned above, the stable manure and the work of the cattle at the end of the year are placed to the credit of the milch cow department:

	£	s.	d.
Net returns	824	19	4
478 tons of dung	138	5	8
Value of cattle at end of year	839	4	4
Total returns	£1802	9	4

On the other hand, in addition to the net expenditure, the milch cattle department has incurred further expenses, as is shown below:

	£	s.	d.
Net expenditure	564	4	5
Share of cost of management	65	5	11
" " " " insurance		16	11
" " " " buildings	20	5	11
" " " " machinery and implements	4	6	11
" " " " lighting cowshed		19	0
" " " " annual salaries	101	1	9
" " " " daily wages (cowmen, etc.)	34	14	2
" " " " work of the teams	13	5	9
Milk for calves	24	6	5
Marketable crops	17	9	5
Unmarketable crops:			
148 tons green fodder	44	2	4
133 tons fresh beet leaves	19	17	1
295 tons ensilaged beet leaves	44	2	4
2 tons clover hay	4	1	7
25 tons straw for feeding	24	18	0
50 tons bedding straw	37	5	7
Value of cattle at beginning of year	758	7	2
Total expenses of milch cow keeping	£ 1779	10	11
Receipts (see above)	1802	9	4
Profit	£ 22	18	5

The interest on the capital invested is, however, not taken into account. The value of the milch cows, including the necessary buildings, implements and food rations for the same, amounts to a total of £1781 19*s.* 3*d.* This capital has, in the above-mentioned year, according to the method of calculation set forth, brought in 1.3 per cent. of interest.

As has been said, the above case is only taken as an example, from which no conclusions can be drawn as to the profitableness of milch cow keeping in general. The interest dors not lie here in the result, but in the method of reckoning the various items which are debited or credited to the milch cow account.

These items well be now separately investigated. There is nothing to be said respecting the charge of 16*s.* 11*d.* for insurance. The sum of £101 1*s.* 9*d.*, which is apportioned for the share of annual salaries, is fairly correct. To determine the share of the work of the day-labourers, assessed at £34 14*s.* 2*d.*, and that of the horses and draught oxen, assessed at £13 5*s.* 9*d.*, it is necessary that a book of the division of labour should be carefully kept. We will return later to the question of the estimate of the home-grown products used for the teams of oxen. The share in the cost of the buildings, £20 5*s.* 11*d.*, and that of the cost of machinery and implements, £4 6*s.* 11*d*, can be arrived at by taking into consideration their value and the method of their employment.

It is far more difficult to apportion the share of the management expenses, *viz.* the expenses incurred in the administration and management of the whole farm. It is best, in this case, to select a definite scale of division, choosing for this either the return from or capital invested in each branch of industry. It is also possible to do as Prof. Laur (Zürich) recommends, *i. e.* to take as the basis of calculation the number of working days of men and animals for each undertaking. It is well to relieve the general expenses account as far as possible by charging the special accounts with the expenditure which directly belongs to them.

The most difficult part in the whole book-keeping is estimating the products grown and consumed on the farm. The estimate of the amount and the computation of the value both present special difficulties. The use to which all marketable produce is put should be entered in the book devoted to natural products, and their value, so far as regards their saleable qualities, must be fixed at the market price, regard being had to their worth, and deductions being made for the expenses of existing methods of transport, etc. The most important question as regards the market, is whether it is more profitable to feed saleable cereals, pulse, etc., or to sell them and buy commercial food stuffs in their place.

The estimate of the milk given to the calves is an unimportant item in the above calculation of profits, which deals with returns and expenditure. If, however, as would often be advisable, the young cattle account is separated from the milch-cows' account, the lower or higher estimate of this milk would make a difference to both accounts. The sale price of 8*d.* per gallon must not be taken into account, for this can only be obtained for the small quantity actually sold ; but the price which the milk is actually worth for purposes other than feeding must be taken as a basis. The corresponding price of milk used for feeding calves would be about 5 $^3/_4$ *d.* per gallon.

The most important point is the valuation of unmarketable produce, on the one hand, and that of dung on the other. In the former case, it is necessary to decide carefully whether these have been cultivated directly

for the requirements of the cattle, *e. g.* mangolds, green fodder; in case they are profitable, this profit is credited to the cattle account, which is also charged with the possible loss. Here also the cost of production must be taken into account. If we have to deal with secondary products, which have been derived from other products, *e. g.* beet slices, straw, or with a substance like hay, which is a product obtained by natural means, the most favourable estimate possible should be made. If the whole product is marketable, the market price is to be taken, but regard paid to quality and expenses incurred. If, however, the whole is not saleable, then the value must be estimated. This is best done on an objective basis, by ascertaining the starch value and having regard to the additional albumen content and the "value" of the food stuff in question. The cost of production cannot here be reckoned, as then all the mistakes in cultivation would be laid to the charge of the cattle. The maximum price of all products is their value on the farm (*loko Hof*) and this limit must not be exceeded.

Particular care is necessary in estimating straw used for litter; its frequently low value must be reckoned with. If every other method of estimation is wanting, or if straw manure is indispensable to the land, it can only be valued as manure; which, according to Krafft, is reckoned according to the organic substances at 19*s.* per ton, but as the quality is often inferior, it should be valued at 15*s.* per ton. If the straw is to be sold at a considerably higher consuming price, the question of a substitute, at all events for part of it, should be considered.

The question of the value of stable manure depends upon what the soil can pay for it. This must be estimated by means of exact manurial experiments, and the writer considers that the carrying out of such researches in as many different farms as possible, with every variety of soil and of crop rotation, should constitute an important feature in the activities of Experiment Stations. Krafft reckons the value of stable manure, exclusive of the organic substance and its specific effect upon the condition of the soil dressed, as on an average, 7*s.* 2*d.* per ton; taking these factors into consideration, stable manure can be considered worth 8*s.* per ton. The excessively low price is, in the case in question, to be attributed to the relatively small albumen content of the food, which on its side, is the necessary result of the low value of milk. To balance stable manure against straw and chaff is a convenient method, but one not to be recommended, as it influences unfavourably the profitableness of cattle keeping and is illogical from the point of view of the various agricultural accounts.

The practical use of the results of calculations based upon reasonable economic principles is, that the farmer who has collected such data for a long time and understands how to test them and to learn the lessons they necessarily teach, will be ready to face the expense and extra work which

they entail. A condition of success is, that the investigator should himself share in the work. Many important questions are still undecided and require elucidation, and the first of these is the relation of cattle-raising to the agricultural account and especially the estimation of home-grown produce used on the farm. In order to answer this question, diligent associated effort is still required.

AGRICULTURAL INDUSTRIES.

1559 – The Score-Card System of Dairy Inspection.

DAIRYING

WHITAKER, GEORGE M. in *U. S. Department of Agriculture, Bureau of Animal Industry, Circular* 199, Washington, July 20, 1912.

Milk inspection was originally limited to the examinatóon of chemical (and sometimes physical) composition, but later on there was added the determination of the contents of bacteria and of contaminations. It is moreover required that the milk should be free from preservatives. In many towns, further, milk having a higher temperature than 50°, and in other cases 60° may not be sold.

These measures alone do not suffice as regards the production of a good milk. In addition dairies should be subjected to systematic inspection. This, if properly carried out, would gradually train the producers to exercise greater care in milk production.

The Score-Card system appears to be the one best adapted for this purpose. This system was first employed in the United States in 1904 by Dr. William C. Woodward for the classification of dairy farms. A few alterations were made in the first score-card used, and in 1908 the Committee of the Official Dairy Instructors' Association prepared a score-card which was endorsed by the United States Departement of Agriculture. We append it below.

A. — (Front of card.)

(United States Department of Agriculture, Bureau of Animal Industry, Dairy Division).

Sanitary Inspection of Dairy Farms.

Score Card.

Indorsed by the Official Dairy Instructors' Association.

Owner or lessee of farm: P. O. address: State: . . . Total number of cows: Number milking: Gallons of milk produced daily: Product is sold by producer in families, hotels, restaurants, stores, to dealer. For milk supply of: Permit N° Date of inspection Remarks:

(Signed) Inspector.

B. — *Back of card.*

EQUIPMENT	SCORE	
	Perfect	Allowed
Cows:		
Health	6	. . .
Apparently in good health: 1		
If tested with tuberculin within a year and no tuberculosis is found, or if tested within six months and all reacting animals removed: . . . 5		
(If tested within a year and reacting animals are found and removed, 2)		
Food (clean and wholesome)	2	. .
Water.	2	.
Clean and fresh: 1		
Convenient and abundant: 1		
Stables:		
Location of stable	2	. . .
Well drained: 1		
Free from contaminating surroundings: 1		
Construction of stable	4	. . .
Tight, sound floor and proper gutter: . 2		
Smooth, tight walls and ceiling: 1		
Proper stall, tie, and manger: 1		
Provision for light: Four sq. ft. of glass per cow . .	4	. . .
(Three sq. ft. 3; 2 sq. ft., 2; 1 sq. ft. 1. Deduct for uneven distribution)		
Bedding	1	. . .
Ventilation	7	. . .

METHODS	SCORE	
	Perfect	Allowed
Cows:		
Cleanliness of cows	8	. . .
(Free from dust, 8; free from coarse dirt, 6)		
Stables:		
Cleanliness of stables	6	. . .
Floor: 2		
Walls: 1		
Ceiling and ledges: . . 1		
Mangers and partitions: 1		
Windows: 1		
Stable air at milking time	6	. . .
Freedom from dust: . . 3		
Freedom from odors . 2		
Cleanliness of bedding: . 1		
Barnyard	2	. . .
Clean: 1		
Well drained: 1		
Removal of manure daily to field or proper pit . . .	2	. . .
(To 50 feet from stable, 1.)		
Milk room or milk house:		
Cleanliness of milk room	3	. . .
Utensils and milking:		
Care and cleanliness of utensils	8	. . .

Provision for fresh air, controllable flue system : 3			Thoroughly washed : 2		
(Windows hinged at bottom 1.50 ; sliding windows, 1 ; other openings, 0.50)			Sterilized in live steam for 15 minutes 3		
Cubic feet of space per cow, 500 ft. : 3			(Placed over steam jet, or scalded with boiling water, 2)		
(Less than 500 ft., 2 ;			Inverted in pure air : 3		
less than 400 ft., 1 ;			Cleanliness of milking	9	. . .
less than 300 ft., 0 ;)			Clean, dry hands : 3		
Provision for controlling temperature : 1			Udders washed and dried : 6		
Utensils :			(Udders cleaned with moist cloth, 4 ; cleaned with dry cloth or brush at least 15 minutes before milking, 1)		
Construction and condition of utensils	1	. . .			
Water for cleaning	1	. . .			
(Clean, convenient, and abundant)			*Handling the milk :*		
Small-top milking pail	3	. . .			
Facilities for steam	1	. . .	Cleanliness of attendants in milk room	2	. . .
(Hot water, 0.50)			Milk removed immediately from stable without pouring		
(In milk house, not in kitchen)			from pail	2	. . .
Milk cooler	1	. . .	Cooled immediately after milking each cow	2	. . .
Clean milking suits	1	. . .	Cooled below 50° F.	5	. . .
Milk room or milk house :			(51° to 55°, 4 ; 56° to 60°, 2)		
			Stored below 50° F.	3	. . .
Location : Free from contaminating surroundings . .	1	. . .	51° to 55°, 2 ; 56° to 60°, 1)		
Construction of milk room	2	. . .	If delivered twice a day, allow perfect score)		
Floor, walls, and ceiling : 1			Transportation below 50° F	2	. . .
Light, ventilation, screens : 1			(51° to 55°, 1.50 ; 56° to 60° 1.)		
Separate rooms for washing utensils and handling milk	1	. . .			
Total . . .	40	. . .	Total . . .	60	. . .

Equipment + Methods = ... Final Score.

Note 1. — If any exceptionally filthy condition is found, particularly dirty utensils, the total may by further limited.

Note 2. — If the water is exposed to dangerous contamination, or there is evidence of the presence of a dangerous disease in animals or attendants, the score shall be 0.

The Author gives a full explanation of the application of the score-card system.

A. *Equipment.* The points for *health* may be reduced to nil even if there is only one cow in a stable affected with a serious disease. The same is the case if bad forage in process of decomposition is fed to the animals. If the forage is mouldy a deduction may also be made under « Stable air at milking time », Whether the food ration is of proper composition or is economical is disregarded.

With regard to the *water* it is taken into account whether there is any danger of the wells being contaminated by drainage water, gutters, W. C.' s, etc.

The *stable* is required to stand on a soil which allows the water to run off readily ; the site must be drained. If in the vicinity of the cow-shed there are horse stables or piggeries, fowl houses or other structures which deteriorate the air or breed flies, the score is reduced. The same applies if the yard of the cow stable is itself unclean. A good stable is required to have a tight, sound floor, readily cleaned manger without corners in which dirt can lodge, a well laid gutter behind the cows for receiving the excrement and level, compact walls with a like roof. The full number of points for air is only given if there is a sufficiency of glass windows and they are uniformly distributed. The *bedding* is classified acording to its quantity sufficient or insufficient — under " Equipment " and according to its quality — freedom from dust and mould — under " Methods ". For ventilation the full number of points may be given if a well arranged ventilation on the " King " system is provided ; if provision for ventilation is only made by means of windows, the score depends on the construction of the windows. In judging the *air space per cow* not the number of cows standing in the stable at the time of inspection, but the number of cow stalls is taken into account. In colder regions a deduction is made under " Regulation of Temperatire " if there are more than 1000 feet of air space per cow. In the division " Implements " the most important features will be seen from the score-card itself. Only irrigation coolers are considered as being milk coolers ; if the milk is cooled in a water tank, ¼ th of a point may be allowed. A special *milk room* is essential. If there are pig houses, manure steads, etc. near it, and if it is not protected against flies, it cannot obtain a full number of points.

B. *Methods.* Well tended cows receive the full number of points, if long hair is clipped away from the folds of abdominal skin and the udder. In judging the *cleanliness of the stable* note is taken whether the walls are free from dung and all parts, including all corners, free from dust and cobwebs. The *stable air* may be contaminated both by dusty fodder and also by silage, brewers' grains, etc., if the feeding takes place directly before milking. Dusty straw also deteriorates the air. If the *milk room* is also

used for storing other things, the full score is not allowed even if it is kept clean. If the inspection of a dairy farm cannot be so arranged that the inspector is present during milking, he judges the latter from the particulars given him about it and from the cleanliness of the cows, the straw, the stable, the clothes of the milker and the contents of dirt in the milk. With several inspections per year the inspector can pretty soon satisfy himself on this point. For *handling milk* the full number of points can only be allowed if each milking is immediately conveyed to the milk room and cooled. The milk should never be poured from one recipient into another in the stable itself. By *transport* of the milk is meant conveyance to the railway station or to the buyer.

This system of scoring is already being applied in many States of the Union by the competent officers. It has also been introduced into most Agricultural Colleges. Many large milk vendors use it to form an opinion on the dairy farms from which they obtain their milk supplies. In 169 towns with a population of over 22 millions, inspection of the milk farms engaged in supplying these towns is conducted on this system. In 109 other towns situate in 32 States, the Dairy division of the Department of Agriculture is carrying on propaganda for the adoption of the system.

Since the use of the score-card system of inspection of dairy farms a tendency is observable in many quarters towards improvement of defective conditions and equipment. This is manifested in an increased score. The following short statement provides confirmation.

Towns	Average Score	
	1909	1910
Los Angelos, Cal.	55	63
Glens Falls, N. J.	49	62
Concord, N. H.	40	46
Hudson, N. J.	40	50
Clinton, Iowa	56	67
Portland, Oreg.	36	45

Many towns stimulate further improvement by publishing the score attained by each dairy farm. These scores are published partly in separate bulletins and partly in dairy papers.

For the classification of town milk selling establishments (" city milk plants ") and their equipment on the score-card system, the Dairy Division has also prepared a score-card which we append.

A similar score-card is in existence for milk depots organised by the milk producers themselves.

Sanitary Inspection of City Milk Plants,

Owner or manager: *Trade name:*

City: *Street and N°:* *State:* *Number of wagons*

Gallons sold daily-Milk: *Cream:* *Permit or License N°:*

EQUIPMENT	SCORE		METHODS	SCORE	
	Perfect	Allowed		Perfect	Allowed
Building:			*Building*	15	. . .
Location; Free from contaminating surroundings . .	2	. . .	Cleanliness:		
Arrangement.	6	. . .	Floors: 3		
Separate receiving room: 1			Walls: 1		
Separate handling room 2			Ceilings: 2		
Separate wash room: 1			Doors and windows: 1		
Separate sales room: 1			Shafting pulleys, hangers, pipes: . . 1		
Separate boiler room: 1			Freedom from odors: 2		
			Freedom from flies and other insects . 3		
Construction.	8	. . .	Drainage: 2		
Floors tight, sound, cleanable: . 1			*Apparatus*	16	. . .
Walls tight, smooth, cleanable: . 1			Cleanliness:		
Ceilings smooth, tight, cleanable: 1			Thoroughly washed and rinsed: . . 6		
Provision for light: 1			Sterilized in live steam, 30 minutes: 5		
Provision for pure air: 1			(Thorougly scalded, after washing, with water over 200° F. or live steam, 3.)		
Screens: 2			Bottle caps sterilized: 3		
Minimum of shafting, pulleys, hangers, exposed pipes etc.: 1			Protected from dirt: 2		

Apparatus		20	...	*Handling milk*		16	..
Boiler	2			Received below 50° F.:	5		
(Hot-water heater, 1)				(50° — 55°, 4; 55 — 60° 3.)			
Milk cooler:	2			Rapidity of handling in plant:	3		
Refrigerator:	2			Freedom from undue exposure to air in the plant:	2		
Appliances for cleansing utensils and bottles:	2			Capping bottles by machine:	1		
Racks, etc., for utensils and bottles after cleaning:	1			Bottle top and cap protected by covering:	2		
Sterilizer for utensils and bottles:	2			Storage 45° F. or below:	3		
Bottling and capping machine:	1			(45° — 50°, 2; 50° — 55°, 1.)			
Wash bowl, soap and towel for attendants:	2						
Protection during delivery:	2			*Inspection*		9	..
Condition of apparatus (make deduction for inaccessible parts, open seams, rusty ware, decayed or battered tables or sink, milk carrying pipes with rough interiors and lack of frequent hand couplings, and for badly worn and poorly repaired material):	4			Bacteriological work:	4		
				Inspection of dairies supplying milk:	5		
				(Once a year, 1; twice a year, 2; three times a year 3; four times a year, 4)			
				Miscellaneous		4	..
Laboratory and equipment: 4		2	...	Cleanliness of attendants:	2		
Water supply		2	...	General appearance, hands, etc. 1; clean, washable clothing, 1)			
Clean, fresh: 1				Cleanliness of delivery outfit:	2		
Convenient and abundant: 1							
Total		40	...	Total		60	...

Date of inspection:
Score for equipment: *plus score for methods*: = *equals total score*:
. *Inspector.*

Note. — If the conditions in any particular are so exceptionally bad as to be inadequately expressed by a score of zero the inspector can make a deduction from the total score.

1560 – A Simple Butter Color Standard.

AYERS, S. HENRY: *U. S. Department of Agriculture, Bureau of Animal Industry, Circular* 200, 3 pp. + 1 fig. Washington, 1912.

The object of the butter standard is to compare the color of butter fat in a melted condition with liquid colors of definite chemical composition.

The apparatus consists of a specially constructed rack, a small glass funnel with filter papers to fit, and a small porcelain dish. The rack is constructed of wood and arranged to hold 22 test tubes. The strip of wood along the front is placed so that only 1 3/4 inches of the lower part of the test tubes may be seen. At the back a strip of ground glass extends from the bottom to the top. The test tubes used in the rack are approximately 12 by 100 millimetres. Eleven test tubes filled with standard color solutions corresponding to the numbers 1 to 11 and ranging from light to dark are placed in the rack. Each test tube contains approximately 9 cubic centimeters of color solution. After the solution is put in the tube the open end should preferably be drawn out with heat and closed, or it may be corked with a cork stopper which has been soaked in hot paraffin and then sealed with sealing wax. When making an apparatus of this type, test tubes of the size mentioned must be used, as larger or smaller tubes would not show the true shades and so would change the standard.

The tubes in the rack are filled with a solution of chemically pure potassium bichromate of varying strengths so arranged as to give a range of color from a light to a dark yellow. Each shade is given a numerical value and is made as shown below:

Composition of colors in the butter color standard.

Color No.	2 per cent. solution of $K_2Cr_2O_7$.	Distilled water added
	cc.	cc
1	1	100
2	1	75
3	1	50
4	2	50
5	3	51
6	5	60
7	7	63
8	9	48
9	12	48
10	21	49
11	32	48

No. 1 of the colors is the lightest shade, No. 11 the darkest; No. 7 corresponds to the color of normal June butter. Only chemically pure potassium bichromate and distilled water must be used.

To determine the color of butter by this standard, melt a small amount and when hot filter through the filter paper directly into an empty test tube of the same size as those in the standard. The fat should be filtered until perfectly clear, and care should be taken to have no water mixed with it. The tube of butterfat should then be heated until hot, as when cooled it is not perfectly clear and will not match the chemical standards. To determine the color of the sample the tube of hot butterfat is inserted between the tubes of the standard and moved along the scale until the color of the fat matches one of the chemical tubes. It is then designated with the number of the tube to which it corresponds the nearest in color. To compare the color the rack should be held before a strong light (daylight and not artificial light), the lower front edge being held on a level with the eye and slightly higher than the back edge of the rack.

It is advisable when not using the standard to keep it in a dark closet since the presence of a slight amount of organic matter introduced through imperfectly distilled water or unclean tubes might slowly cause a slight change of color if the standard were constantly exposed to a strong light.

It is believed that this standard — which has been sussessfully used by one of the large butter companies — offers a simple and accurate method of measuring the color of butter. The standard should be of greatest value in the spring and fall, when the feed of the cows is changed from dry to green or from green to dry, since at these periods the color of butter varies the most. Slight changes in the color of butter may not be noticed by the butter maker in his daily churnings, but will be shown by daily tests with the color standard. By thus determining the color any change from the uniform shade desired will be seen, and the color may be kept up to normal by varying the quantity of coloring matter.

1561 – **Animals for Slaughter and the Meat Trade in Belgium.** MEAT INDUSTRY

Ministère de l'Agriculture et des Travaux publics. Office rural. Commission de la Boucherie. Rapport, pp. 1-35. Bruxelles, 1912.

By Ministerial decree of the 24th November 1911 the Ministry of Agriculture and Public Works of Belgium appointed a delegated Commission to carry out investigations within the limits of the present customs and health legislation, with regard to the improvements to be made in the cattle and meat trade.

The Commission took in hand the study of the questions relating to the supplying of markets, the trade and consumption of meat.

This report is the result of the individual reports made by the members of the Commission and the corresponding discussions, and is divided into the three following parts.

1. *Supply of markets.* — The present home production is insufficient for the consumption of the country, especially as regards sheep, the number

of which, as occurs in all countries where intensive cultivation is spreading, is in continual reduction.

With regard to oxen, although their number has increased during late years, the annual average number of head imported and exported shows a difference of the former of 64392. At present, importation supplies 5 per cent. of the cattle slaughtered. This proves that the importation of large cattle from abroad, though necessary, is of no great importance.

The results obtained up till now in Belgium for increase and improvement of large cattle are noteworthy. Whereas in 1880 there were 250.5 head of cattle per 1000 inhabitants, in 1909 there were 258.9, notwithstanding the increase of the population. This increase refers particularly to young cattle. Nevertheless it is endeavoured to continue the development of home production of cattle in order to render the nation independent of foreign importation.

Belgium is however in particularly difficult conditions from the point of view of cattle breeding, because every year sees a reduction in the area intended for cultivation and breeding in consequence of the continual extension of roads, canals and civil and industrial buildings. Notwithstanding this, the number of domestic animals in proportion to the territory is higher in Belgium than in any other country. The cattle are much more numerous on small farms than on the large ones (69 and 32 head respectively per 100 acres), which is due to the scarcity of labour, which the Commission proposes to remedy by the extension of the use of agricultural machinery.

In order to reduce the injury due to epizootic diseases the Commission demands that control measures against the latter should be vigorously carried on.

An important factor in the increase of cattle is the putting under cultivation of lands now lying waste, for which purpose a very effective factor will be the combination of the individual powers of the owners under the style of the Dutch association *Heideontginningsmaatschappij* (Heath Reclamation Society).

It is meantime necessary to make up for the insufficiency of the home production of meat, and this can be done in two ways : *a*) by the importation of dead meat ; *b*) by the importation of live cattle. The Commission prefers the second method, because for the first the necessary plant for keeping is wanting, nor is it known how consumers would welcome American frozen or simply chilled meat. It is proposed that importation should be allowed not only of fat stock but also of store stock with four teeth, to be fattened in the country, in order to be able the better to face the competition offered by cattle fattened abroad to home fattened animals.

II. *Trade.* — With regard to the trade in animals for slaughter in Belgium, it is noted that annually 750 000 to 800 000 head are killed, coming

from the markets of Courtrai, Bruges, Ghent, Antwerp, Liège, Namur, Anderlecht and Brussels. The butchers however to a large extent buy direct from the breeders, to the amount indeed of 63 to 64 per cent. of their requirements. To do away with the disadvantages presented by the markets, especially from the point of expense and the danger of diseases encountered in sending back to their place of origin about 50 per cent. of the animals offered for sale, it has been proposed to annex a refrigerator to all the cantonal abattoirs, but it was found that apart from those existing in the large abattoirs, these refrigerators could not work remuneratively unless they likewise carried on the sale of ice, but this cannot be at all profitable, and therefore the deficit occurring would be charged on the price of the meat. In addition, this system would facilitate speculation on meat by the creation of trusts and combines, which are always to be feared.

Important improvements are to be introduced in the transport of meat and cattle both as regards the duration of the journey and the trucks used for transport, in which there is at present insufficient ventilation and little cleanliness.

The Commission had to acknowledge that one of the most urgent requirements for the improvement of the trade in butchers' animals is the creation of an official list which should reproduce the condition of the market exactly. The figures now published without control are not very reliable and at times aimed at influencing the market. An official market list should be issued by a committee of three members, one delegated by the sellers, another by the buyers and a third by the Ministry of Agriculture. The prices should be established for each market and each class of animals, distinguishing in each class three different qualities. The list should be completed by the number of the animals of each class which remained unsold and all other useful particulars as to the state of the market.

III. *Consumption.* — The Commission has satisfied itself of the insufficiency of the official returns on the consumption of meat in Belgium, especially with regard to the weight and yield of meat of the animals slaughtered. It is therefore desirable that the Government, availing itself of the control work of the directors of the abattoirs and agents, should publish annually, or more often if possible, a return of the animals slaughtered.

To facilitate the sale of cuts which are not of the best quality and poor meat, which to-day finds few buyers, it would be desirable for the butchers to offer the public meat put into a condition for immediate consumption or rapid cooking; it would also be expedient to combat the prejudices against the use of meat of inferior quality in the courses of instruction in domestic economy.

From the tables published in the appendix to this report the following figures are taken:

	1907	1910	1911
Imports of cattle	74 007	71 455	51 544
Exports „ „	131	413	221
Total head alive in the country	1 812 689	1 856 833	—
Number of animals slaughtered	793 857	811 095	—
Head of cattle per 1000 acres	262.7 (in 1909)		
„ „ „ „ 1000 inhabitants	258.9 (do.)		
Number of cattle offered for sale in the markets of Anderlecht	166 281 (in 1911)		
Number of cattle offered for sale in other markets	145 982 (do.)		
Total	312 263		

WINE-MAKING

1562 - Method of Increasing the Phosphatic Principles in Wines.

PATUREL, G Comment enrichir les vins en principes phosphorés. — *La Vie Agricole et Rurale*, No. 41, pp. 392-395. Paris, September 7, 1912.

The systematic use of phosphatic fertilizers in vineyards has produced a distinct acceleration in ripening, increased setting of fruit, improved ripening off of the wood, greater resistance to fungus diseases and a marked increase in the sugar content of the grapes. The quality of the wines is thus influenced by the amount of the phosphoric acid in the soil; this influence is further confirmed by the analysis of the wine itself, wines of superior quality being always rich in phosphates. According to M. Müntz, "the superiority in quality is accompanied by a larger nitrogen and phosphate content; this is perhaps not without influence on some of the taste properties, which make so much differences in the price of wines."

It seemed to the writer to be also a matter of interest to ascertain whether this agreement between the large amount of phosphates and the quality of the wines is found equally in products of the same origin, and for this reason he made a study of the wines of the Maçonnais-Beaujolais. In the following table the average results are given of the determinations made by the writer in the case of the different classes and which are based on the prices at which the wines are offered for sale.

Average content of phosphoric principles ($P_2 O_5$) *per litre.*

Year	1st class	2nd class	3rd class	4th class	General average for the year
	gr.	gr.	gr.	gr.	gr.
1901	0.206	0.175	0.159	—	0.180
1902	0.279	0.244	0.193	—	0.238
1903	0.375	0.333	0.251	0.229	0.297
1904	0.292	0.264	0.255	0.243	0.263
1905	0.162	0.134	0.113	0.050	0.115
1906	0.394	0.334	0.265	0.239	0.308
1907	0.282	0.296	0.231	0.196	0.251
1908	0.294	0.284	0.254	0.175	0.252
1909	0.317	0.267	0.213	0.174	0.243
1911	0.398	0.382	0.372	0.340	0.373

These results completely confirm the parallelism previously affirmed between the general quality of the wines and their richness in phosphate compounds. In fact, regularly, and without exception in the case of the ten vintages, the average amount of phosphoric acid diminishes in passing from the first to the fourth class, thus following the order of the quality and commercial value of the wines. The results are similar when the general quality of the vintage has been satisfactory (1906 and 1911) or mediocre, as in 1905.

The comparison of the general averages for the year entered in the following table is still more interesting. This comparison is a fair one, for the wines analysed came each year from the same wine-growing communes. It was found that the average content for the year varied largely from 0.115 gr. in 1905 to 0.373 gr. in 1911. It can be seen by the simple examination of the results, that a relation also exists between the general quality of the wines and their content of phosphoric compounds. Moreover, the writer shows in the following table the order in which the products of the ten years of observation are classed, on the one hand as regards their general average content of phosphatic compounds, on the other, according to the opinion of the three chief wine merchants of Mâcon.

Average annual content of phosphoric acid		Wine merchants' opinions		
1	1911	1	1911	Exceptional
2	1906	2	1906	Superior
3	1903	3	1904	Very good
4	1904	4	1903	Good
5	1908	5	1908	Fair
6	1907	6	1907	Fair
7	1909	7	1909	Passable
8	1902	8	1902	Passable
9	1901	9	1901	Poor
10	1905	10	1905	Poor

Thus, except for the inversion of the order of the years 1903 and 1904, the classification of the wines from the point of view of their general qualities is identically the same as that arrived at when they are classified according to the wine merchants' opinion or according to their content of phosphatic compounds. It thus appears to the writer to be proved, that the best criterion of the quality of wines is their phosphorus content, and that the determination of the latter is much more important than that of the amount of alcohol or of the other compounds which are usually estimated.

As the quality of wines increases with the amount of phosphate compounds present, various methods have been tried to increase the latter. This is certainly attained by prolonged fermentation, but unfortunately

short periods of fermentation are considered indispensable in the Beaujolais in order to preserve the bouquet and quality of the wine. The application of phosphates to the vintage only increases the inorganic phosphates present, but the development and fixing of the bouquet is brought about by the different organic phosphorus compounds ; thus it is the latter which must be increased.

Many experiments have long ago proved the good effect of chemical, and especially phosphatic, fertilizers on the qualities of wines. It was interesting to discover whether this improvement in quality was accompanied by a parallel increase in the amount of phosphates and whether a portion of the phosphoric acid introduced into the soil by fertilizers is found in the grapes and the wine. The analysis of three ripe samples of Gamay grapes gathered the same day from plots of soil of which one was unmanured, while the two others were supplied with slag and superphosphates, gave the following amount of phosphoric acid per 100 kg. of grapes :

	Control gr.	Slag gr.	Superphosphate gr.
Strigs	1.78	3.52	3.40
Pips	10.80	10.38	11.00
Skins	11.32	15.54	16.40
Juice	7.78	9.96	15.43
	31.68	39.40	46.23

These figures show that the amount of phosphoric acid present in the juice is considerably increased by means of fertilizers ; this increase is especially interesting, since it is from the juice that the wine obtains the greater part of its phosphatic compounds.

A similar analysis, but carried out on the wines, was made in Vaucluse by M. Zacharewicz. Four experimental plots were given equal amounts of nitrogenous and potash fertilizers and, in addition, increasing quantities of superphosphate. The resulting wines contained the following quantities of phosphoric acid per litre :

	Phosphoric acid gr.
Control	0.077
Superphosphate 45 kg.	0.600
„ 90 „	0.480
„ 135 „	0.790

The control wine is 10 times less rich than that from plot 4, and 8 times less than that from plot 2.

From these facts it is evident that wines undergo a considerable increase in their content of phosphate compounds when recourse is had to fertilizers.

1563 - " Laghbi " or Palm Wine in Tripoli.

NAPPI, R. Il laghbi o vino di palma in Tripolitania. — *Bollettino del Ministero di Agricoltura Industria e Commercio*. Year II, Vol. II, Series B, Parts 1 and 2, pp. 11-12. Rome, July 1 and 15, 1912.

" Laghbi " or palm wine is a whitish, almost milky liquid, slightly acidulated but distinetly sweet in taste. Its tapping is begun immediately after the flowering of the palm, *i. e.* in April, being continued until late in October. The operation is effected by almost completely stripping the tree of leaves and cutting into the apex of the trunk with a sharp instrument, so as to scoop out a cup-shaped hollow, a tube with slight outward inclination being inserted into the bottom. In two or three days after the incision the juice begins to run out in a continuous and regular flow, which is gathered in special eartken vessels, " acabra ", of a capacity of 2 ½ to 3 gallons, manufactured at Bumeliana. The palms intended for tapping are those with big trunks of the variety known by the name of " bakrari ". By preference the older palms are chosen as their production is naturally tending to fall off.

Generally, a palm exhausts its juice in about two months, producing daily about 2 gallons, but sometimes 4. After this a period of enfeeblement ensues and it ceases to give fruit for three years. The consumption of " laghbi " at Tripoli is fairly high ; suffice it to say that there are more than one hundred retailers ; restorative medicinal qualities are ascribed to it.

The tapping of " laghbi " is an operation which, if not practised with the necessary precaution, leads to the rapid decay and subsequent death of the plant ; it is calculated that one third of the palms do not survive the incision. The Governor of Tripoli on the 13th of April 1912 promulgated a decree making a special authorisation requisite before palm-tapping, and imposing a tax of 40 lire (32*s*). per tree, to be devoted to purposes of public charity.

PLANT DISEASES.

GENERAL INFORMATION.

1564 - **Italian Ministerial Decree of the 8th July 1912, determining the Mode of Publication of Ministerial Orders in relation to Phylloxera.**

Decreto ministeriale dell'8 luglio 1912, col quale si determina il modo di pubblicazione degli ordini del Ministero concernenti la fillossera. — *Bollettino del Ministero di Agricoltura, Industria e Commercio, Parte ufficiale*, Year XI, Vol. II, Series A, Part 7, p. 144. Roma, August 17, 1912.

The Ministry of Agriculture, Industry and Commerce has decreed :

" Article 1. The Orders of the Ministry of Agriculture and the directions of its special Delegates for the destruction of the areas infected with phylloxera and the safety zones, for the determination of the zones of defence and the prohibition of cultivation of lands, laid down by decree of the same date, shall be immediately published in the town hall notices of Communes infected with or suspected of infection with phylloxera ; such publication to be effected by the Mayors, who shall make a declaration of publication having taken place on the copy of the orders or instructions given them by the Delegate of the Ministry. "

" Article 2. Persons committing a breach of the aforesaid orders and directions, and also of the Ministerial Decree of the same date with regard to cultivation of properties where phylloxera-infested vines have been destroyed, shall suffer the penalties laid down in the single text of the anti-phylloxera laws of the 4th March 1888, No. 5252. "

1565 - **Italian Ministerial Decree of the 8th July 1912, in Regulation of the Prohibition of Cultivation in the Areas infested with Phylloxera and the Safety Zones of the Centres of Phylloxera Infection.**

Decreto ministeriale dell'8 luglio 1912, che regola il divieto di coltura nelle aree infette dalla fillossera e nelle zone di sicurezza dei centri d'infezione fillosserica distrutti. — *Bollettino del Ministero di Agricoltura, Industria e Commercio, Parte ufficiale*, Year XI, Vol. II, Series A, Part 7. p. 143. Roma, August 17, 1912.

The Ministry of Agriculture, Industry and Commerce has decreed :

" In the infested areas and the safety zones of centres of phylloxera infection already destroyed, and after the operations of destruction of those which will be subjected to this treatment, the prohibition of cultivation shall be regulated as follows :

a) Until 1st November of the year following that in which the operations of destruction were carried out, all and every cultivation is prohibited ; *b*) after this time, for a further two years, only such cultivation is allowed as does not involve movement of the soil beyond 22 cm. (8 ½ in.) deep; nevertheless in the area subjected to destruction and previously under mixed crops, such crops may be authorised on condition of the directing and carrying out of the eradication of the vines and injecting into the soil of 40 gr. of carbon disulphide per square metre (1 ¼ oz. per sq. yd.); *c*) on the expiry of the said two years' period all crops are allowed, except in special cases ".

" These dispositions shall not be applicable to lands on which the destruction of the diseased vines has been discontinued, and all the previous dispositions in the matter of prohibition of cultivation on land to which the destructive system has been applied are hereby repealed ".

The Delegates for the operations of destruction of phylloxera and the technical anti-phylloxera Delegates are entrusted with the enforcement of the present decree, which shall be registered in the Court of Accounts.

1566 - Prohibition of Sale of Vines and Parts of Vines on the Public Markets, in all the Provinces of the Kingdom of Italy, by Ministerial Decree of the 8th July 1912.

Decreto ministeriale dell'8 luglio 1912, che vieta, in tutte le provincie del Regno, la vendita, sui pubblici mercati, delle viti e parti di viti. — *Bollettino del Ministero di Agricoltura, Industria e Commercio, Parte ufficiale*, Year XI, Vol. II, Series A, Part 7, pp. 142-143. Roma, August 17, 1912.

The Ministry of Agriculture, Indusrty and Commerce, with the object of preventing the spread of phylloxera, decreed under date of the 8th July 1912 :

"In all the provinces of the Kingdom it is prohibited to sell vines, grafts, slips, or cuttings of vines in the public markets, and all the previous enactments in this matter are repealed. "

" The Prefects of the several provinces are entrusted with the execution of the present decree which shall be registered in the Court of Accounts. "

1567 - Administrative Regulations for the Control of Field Voles in France (1).

Les campagnols. — *Journal d'Agriculture pratique*, 1912, Vol. II, No. 38, p. 359. Paris, September 19, 1912.

The Minister of Agriculture, acting jointly with the Minister of Finance, has obtained authorisation from the Council of Ministers held on the 12th

(1) See No. 1488, *B.* Oct. 1912. (*Ed.*).

September 1912, to submit to the Council of State a decree requiring the grant of an extraordinary credit of 250 000 francs (about £ 10 000) to be devoted to suppressing the invasion of field voles in the eastern departments of France.

The Minister of Agriculture has invited the Prefects of the Departments concerned to take steps in order that preventive measures against field voles may be made obligatory in the regions over-run by them. The animals will be destroyed by sprinkling over the soil, and as far as possible at the mouth of their holes, crushed grain steeped in the special virus prepared by the Pasteur Institute in Paris, at the rate of 10 kg. of grain and one bottle of virus per hectare. Virus will be supplied free of charge to farmers making application to the Prefecture and indicating the extent of land to be treated.

STATIONS FOR PLANT PATHOLOGY AND AGRICULTURAL ENTOMOLOGY.

1568 - Work of the Station of Plant Pathology and the Plant Health Service at Santiago de Chile, in 1911.

A Communication from the Director, Señor CARLOS CAMACHO, *to the International Institute of Agriculture.*

By the establishemnt of the Plant Health Service and the construction of new laboratories, the Station of Plant Pathology in Santiago de Chile, in 1911 entered upon a period of more extensive and fruitful work.

Numerous fungi and insect pests of fruit trees and also of other crops have been examined by the Station, which has for some years now undertaken experiments for the control of the different plant diseases observed in the region. In order to give practical demonstration to agriculturists of the possibility of succesfully combatting these adverse influences, special gangs were organised, trained in the preparation of the remedies to be employed and the handling of the corresponding appliances. Although the first gang organised only began its work in November 1911, the number of trees treated already, at the end of the year, numbered several thousands and the results obtained were excellent.

Connected with the Station is a special Laboratory for seed control, where specimens of all imported seeds come to hand. If the latter are found to be infected, instructions are transmitted by telegraph to the Custom house whence the sample comes, for corresponding disinfection. The laboratory already possesses a rich collection of pure, well classified seeds, while the Station has a similar Plant Diseases collection.

In consequence of the extension of the experimental field of the Station there will be built thereon a house for the propagation of insects which are parasites of the pests to local agriculture.

The Plant Health Service appointed by decree No. 674 of the 11th March 1911, began to operate on the 21st of the same month at the Custom houses of Valparaiso and Talcahuano, with a staff instructed for the

purpose by the station. During the brief period of its existence this Service has already provided results of indisputable value in preventing by careful preliminary inspection, of both the seeds and live plants, the importation of new and serious diseases.

There follows the list of the seeds and living plants which reached Valparaiso, Talcahuano and Puerto Montt and the quantities of the same subjected to disinfection by the Plant Health Service :

1. *Lucerne.*

Valparaiso	395 124	tons (1)
Talcahuano	5 523	tons
Total . . .	400 647	tons,

of which 119 338 tons were disinfected.

2. *Various forage plants.*

Valparaiso	3 489.5	tons
Talcahuano	13 087.5	tons
Total . . .	16 577	tons,

of which 2,000 tons were disinfected.

3. *Cereals, kitchen garden plants, flowers, etc.*

Valparaiso	3 058 062.5	tons
Talcahuano	11 665.2	tons
Total . . .	3 069 727.7	tons,

of which 12 000 were disinfected.

4. *Fruit and forest tree seeds.*

Valparaiso	955.7	tons
Talcahuano	178.4	»
Puerto Montt	25.0	»
Total . . .	1159.1	tons,

of which 150 kg. were disinfected.

5. *Industrial and textile plants (seeds).*

Valparaiso	1 040	tons
Puerto Montt.	12 000	»
Total. . . .	13 040	tons

6. *Fruit, forest and ornamental trees.*

Valparaiso	346 602
Talcahuano	38 676
Total . . .	385 278

of which 12 328 were disinfected.

(1) " Tons " in this article means metric tons : 1 metric ton = 0.9842 English ton, or 1.10231 U. S. ton. (*Ed.*)

7. *Vines (cuttings).*

Valparaiso	1 656
Talcahuano	6 000
Total . . .	7 656,

all subjected to disinfection.

8. *Bulbs.*

Valparaiso	922 329
Talcahuano	4 278
Total . . .	926 607,

of which one-quarter were disinfected or destroyed.

DISEASES NOT DUE TO PARASITES AND OF UNKNOWN ORIGIN

1569 – Obscure Disease of Paddy in India.

Note by S. K. BASU, communicated to the International Institute of Agriculture by the Director of Agriculture, Behar and Orissa.

An obscure disease of paddy causing serious damage to the crop was examined in the Laboratory but, so far, no fungus could be found to have caused the disease; and it has been suggested that perhaps the disease is due to water-logging or to some other insanitary condition of the soil.

1570 – On the Characteristics of "Roncet" and the "Mosaic Disease" of the Vine (1).

PANTANELLI, E. Sui caratteri dell'arricciamento e del mosaico della vite. — *Malpighia*, Year XXIV, Parts V-VI, pp. 497-523, plates I-VIII; Year XXV, Part I, pp. 17-46. Catania, 1912.

From the examination of the external characters of roncet, and comparison with other forms of distortion in vines, it appears that some characteristics, such as the shortness of the internodes, the thickness of the nodes, small size of the leaves, the fasciation and forking of the branches, the deforming of the tendrils and shoots, the falling of the flowers, and the rapid development of the suckers, are not exclusively confined to roncet, while certain symptoms are peculiar to the disease, *viz.* deforming of the leaves, which are laciniate and lobed and toothed, resembling parsley, with an interlacing of pale nerves at the base of each

(1) See also No. 572, *B.* March 1912; Nos. 968 and 969, June 1912; No. 1097, July 1912; Nos. 1349 and 1350, Sept. 1912. (*Ed.*).

sinus between the lobes, the typical form occurring in the Rupestris varieties and their hybrids. It would be more correct to call it " persillage, " (parsley-leaf) seeing that the presence of leaves resembling that of the bramble (ronce) is not a specific character.

A constant symptom of the severer form of the disease, in the case of the varieties of Rupestris and Vinifera, is the presence of light-coloured patches, or " mosaic," on the leaves ; they are exactly the same as those which appear on tobacco, tomato and melon plants, etc.

Disregarding the initial stage, three forms of roncet can easily be distinguished : *a*) the true roncet, typical of Rupestris, common also in Riparia glabra and many Viniferas, which is characterised by the laciniate form of the leaves, without any abnormality of other organs, shortening of the internodes being conspicuously absent ; *b*) roncet with distortion, typical of Berlandieri and Riparia tomentosa, common among many varieties of Vinifera and Rupestris and characterised by laciniate or deformed leaves coupled with a shortening of the internodes and the reduction of the size of all the organs ; *c*) roncet accompanied by distortion and mosaic, the symptoms of the severest form of the disease in all vines, together with the occurrence of pale patches on the leaves, which are laciniate and deformed, shortness of internodes, and the small size and abnormal condition of all the organs. Roncet and mosaic can occur in Berlandieri without distortion.

The three forms of roncet are independent of one another, and probably due to similar, but not identical causes.

Further, anatomic investigation shows that the only change which is met with in vines infected with true roncet (the first form) is a slight chlorosis along the principal nerves of the leaves and at the end of their finest ramifications, as well as at the base of each sinus of the leaf. In some Rupestris leaves, however, which are typically deformed, all sign of chlorosis is absent. In the second form of roncet the anatomical alterations may also be wanting. When mosaic is present in addition to roncet, the deforming of the leaf depends upon the distribution and extent of the chlorosis, the leaf being not only attacked by roncet, but apparently atrophied in the parts much affected by chlorosis. The appearance of the patches in the leaf parenchyma is followed, more or less rapidly according to the vines and the climatic conditions, by gummosis, which may be succeeded by withering.

The cicatrices or dead patches, the perforations of the lamina, and the superficial excoriations of the other herbaceous organs, are lesions which, although they accompany roncet, frequently in the case of Riparia, Riparia × Berlandieri and rarely in that of Rupestris × Berlandieri, and Riparia × Rupestris, are due to other cuases and are always absent in cases of typical roncet. Further, they are less severe in Sicily than in

places more exposed to late frosts (Apulia and France). Centres, or nests, of internal gummosis of the herbaceous organs (stems, petioles, tendrils, the rachis of the inflorescence) are never met with in Sicily in vines suffering from typical roncet and are rare in those attacked by mosaic. They are always absent in the shoots of healthy vines, being probably the result of late frosts or sudden drops in the temperature, as has been shown by experiment and proved by Sorauer in the case of similar affections of fruit-trees. Gum-resinosis of the wood, and the frequent invasion of the vines by fungus mycelium, are occurrences which have no connection with roncet : so far no specific parasite has been found in the organs of vines attacked by the latter disease.

1571 – Observations on the Alterations of the Wood of the Vine in Consequence of Wounds.

PETRI, L. Osservazioni sopra le alterazioni del legno della vite in seguito a ferite. — *Le Stazioni Sperimentali Agrarie Italiane*, Vol. XLV, Part, 7, pp. 501-547, figs. 1-7, plate IV Modena. 1912.

The attention of vine-growers and pathologists has often been called to the more or less profound alterations undergone by the wood of the vine as a result of the cuts in pruning. The most salient phenomenon in these alterations consists in the presence within the vessels of a brown gum which becomes evident in the longitudinal section of the stock by the hue of a portion of the woody substance, which extends from the point of the wound sometimes very deep down towards the roots.

The author here sets out the results of the observations made on this form of gummosis in Sicily (provinces of Palermo, Messina and Trapani).

As a result of the pruning wounds in the wood of the vine in both branches of one year and those aged two or more, the following modifications may occur in the lumina of the vessels : the normal pectic gum undergoes coagulation, becoming insoluble in potash and acquiring the property of reacting with fluroglucine and hydrochloric acid, consequently acquiring the characteristics of true wound gums as Temme calls them.

The normal pectic gum may remain unaltered even for a long time, but the perivascular cells pour into its substance quantities of drops of gum resin which swell out and unite into larger or smaller clusters. The pectic gum contained between these resinous masses ends by coagulating. Finally, in the vessels with entirely empty lumina, as in those containing pectic gum, numerous thyloses may develop, or even resinous gum alone. The process of thylosis formation and the coagulation of the pectic gum represent the most effective means of defence against the penetration of the fungi or bacteria, while the formation of resinous gum is — rather than a defensive action — the result of a definitive degeneration of the perivascular cells which converts into fostering centres for semi-saprophytic organisms those vessels where this degenerative process takes place.

It is called forth partly direct by the traumatic stimulus independently of the access of atmospheric oxygen; it is promoted by the constitutional conditions of the plant and its conditions of growth. All the causes which tend to weaken the activity of the nutritive processes are favourable to the resinous degeneration of the perivascular cells in place of their ordinary defensive reaction, which consists in the production of thyloses. The gum-resinosis originating from the wound is afterwards increased and extended even to points far away from the pruning wounds by the indirect action of saprophytic or semi-saprophytic organisms which make their way into the degenerating vessels no longer capable of thylosis, and in which they can develop for lengthy periods. There are thus formed in the wood which is still sound and white, long brown veins which may proceed from the top right down to the roots and continue into the latter. If these veinings become very numerous, especially in the last woody rings, the stock may easily fall a victim to decay.

The formation of the brown veins never takes place in the shoots of one or two years and does not represent a transitory stage in the conversion of the sapwood into ordinary heartwood or into the heartwood produced by wounds. In perfecly sound and vigorous plants the wound is almost entirely free from gum-resin, the vessels contain only pectic gum converted into a compound comparable to Temme's "Wundgummi" and abundant thyloses.

From the veins the author constantly isolated fungi belonging to the genera *Cephalosporium* and *Acremonium*. These micro-oraganisms must be considered as secondary but necessary factors in the traumatic alteration of the wood, and they perpetuate and carry very far the consequences originating from the stimulus of the wound.

BACTERIAL AND FUNGOID DISEASES

FUNGI

1572 – On the Causes which Determine Infertility of the Soil and Loss of Crops.

JACHEVSKI, A. O Pricinakh Niedorodov i Nieuroxaiev. — *Khoziaistvo* (The Farm), Year VII, No. 34, pp. 1103-1108. Kiev, August 30, 1912.

The writer draws attention to the fact, that soil fatigue is often occasioned by causes other than those to which it is attributed. In such cases, neither rotation nor the use of fertilizers is of any avail as a remedy for the loss of crops, or for a poor harvest.

At the end of the nineteenth century, the productiveness of flax decreased in Belgium and the United States to an alarming extent, and it was considered to be due to soil fatigue caused by too intensive cultivation.

Further researches proved this hypothesis to be entirely fallacious and attributed the trouble to *Fusarium Lini*. The same occurred in Russia in 1903.

Of late years, there has appeared in the Baltic provinces, and especially in Lithuania, where intensive cultivation of clover is practised, a serious disease, which attacks the tissues of this plant, producing rotting, and which is caused by *Sclerotinia Trifoliorum*.

Other plants which are intensively cultivated meet with a similar fate. In 1909, the winter cereal crop in the Government of Viatka was almost nil. Careful investigation proved that the disease was due to a fungus, *Sclerotinia Libertiana*, which causes the young plants to wither or decompose. The above-mentioned fungus is widely distributed on a large number of cultivated plants, such as the sunflower, cauliflower, potato, etc., in which it induces rotting of the tissues.

It is an occasional parasite, attacking first only weak or diseased plants and thence spreading to other and healthy hosts. The reports received from various parts of Russia show that the parasitism of this fungus is on the increase and that the injury it causes to sunflowers and other kitchen-garden plants is continually extending. But until 1909, *Sclerotinia Libertiana* had never appeared on cereals; thus without special investigations, the destruction of the grain crops in the Government of Viatka could hardly belaid to its charge.

The fungus probably needed many years to adapt itself to its new substratum, and then became evident and virulent by the formation of a physiological variety on Gramineæ. During this period of incubation, it is certain that here and there injury must have been done, which was attributed to other causes. In fact in 1903, early in spring a considerable mortality was noticed among the seedlings at Urxum; but it was considered due to excessive damp, the result of the rapid melting of the snow.

Phytopathological literature contains many similar cases. In Western Europe, *Fusarium nivale* (syn. *Lanosa nivalis* Fris.) causes the death of young winter cereals accompanied by the usual general symptoms of soil fatigue. Immediately upon the melting of the snow, this fungus covers the young plants with a whitish film of densely felted hyphæ, which send hyphal branches as haustoria into the interior of the tissues, thus depriving their host of a considerable amount of nutritive substances and often causing its death. In the Governments of Central and North Russia, its presence is often observed in the woods and meadows and though, hitherto, no damage has been reported, it is not certain that this parasite by adapting itself to other substrata, may not eventually become suddenly dangerous.

In the same manner, Bolley has shown that generally the loss of crops in the United States which is attributed to soil fatigue, is actually caused by fungus diseases.

In this connection, the following facts have been observed:

1) Sowing wheat for many years in the same field causes an accumulation of the spores of the parasites in the soil and the different sowings are thus infected.

2) The soil is, so to say, saturated with spores, sclerotia, etc., which cause soil fatigue or incompatibility for producing certain crops, *e. g.* in the case of *Fusarium Lini*, which inhibits the growth of flax.

3) Fertilizers have a specific effect on the parasites, and the injury caused by the latter can be increased or diminished by the use of one fertilizer in place of another. The disease is spread to the succeeding crops by means of infected soil and seed.

The fungi do not attack only young plants, but can cause the loss of the crop by injuring older plants during the various stages of growth. Thus *Helminthosporium graminum* makes barley wither; the caryopses of rye are hindered in their development by *Fusarium Secalis* Jacz.; and *Cladosporium herbarum* Link. has for some time been attacking Gramineæ very severely.

From what has just been said, it is evident that the loss of crops is due to various and numerous causes and that the origin of the latter should be determined. True soil fatigue is corrected by rotation and the use of fertilizers, and up to a certain point it is possible to evade the unfavourable action of meteorological factors by selecting the crops best adapted to the climatic conditions of the district; while as for fungus diseases, there exists for their control a well-defined and carefully studied system, which can be summarized as follows:

1) The seeds of cereals should be treated with formalin or sulphate of copper to kill the spores.

2) A system of rotation should be chosen, which will bring about the destruction of spores, or hibernating mycelia, by the formation of a new substratum unadapted to the requirements of these organisms. This is easily done in the case of the specific parasites of determined plants, such as *Helminthosporium graminum* and *Sclerotinia Trifoliorum*. But when it is a question of parasites like *Sclerotinia Libertiana*, which adapts itself to different substrata, rotation can no longer afford satisfactory results. In this case, it is well either *a*) to leave the land fallow for some years in order that the spores, hyphæ and sclerotia may perish from lack of nutrition; or *b*) by means of deep ploughing to cover these organisms with a thick layer of soil, which will hinder their germination.

3) When it is a case of very limited centres of infection and it is desired to prevent the reappearance of the disease, the stubbles should be burnt and the ground disinfected with formalin, kerosene or carbon disulphide.

The Central Mycological and Phytopathological Office (St. Petersburg) examines samples of soil or infected plants gratis and indicates the cause of trouble ; it is thus able to put the intelligent farmer in the way of effectively controlling the famines which, of late years, have devastated certain provinces of Russia with a regularity which is most remarkable.

1573 - The Fungi of Valle Pellina, Piedmont, Italy.

TRAVERSO, G. B. Manipolo di Funghi della Valle Pellina. *Extr. du Bulletin de la Société de la Flore Valdôtaine*, No. 8, 40 pp, Aosta, 1912.

This is the first list of the fungus flora of Valle Pellina, which near Gignod, branches off from the valley of the Great St. Bernard ; one of its tributary valleys ascends towards the Cervin and the other (Ollomont Valley) towards the Grand Combin. The writer visited it in August 1911. In the systematic list, which includes 162 species, there are some species or varieties new to science : *Puccinia Carlinae* var. *Carlinae-acanthifolia* n. var. ; *Leptosphaeria. montana* n. sp. ; *Clathrospora Stipae* n. sp. ; *Aposphaeria Henryana* n. sp. ; *Phomopsis conorum* var. *naviculispora* n. var. ; *Cytospora nigrocincta* n. sp. ; *Septoria Henryana* n. sp. ; *Marssonia valpellinensis* n. sp. ; *Exosporium Meliloti* n. sp.

Other species new to Italy, or worthy of mention for other reasons, are : *Erostella Kriegeriana, Otthia Lisae, Sphaerulina intermixta, Pleosphaerulina rosicola, Lophodermium Actinothyrium, Ascochyta Medicaginis, Melasmia Bartsiae, Heteropatella umbilicata, Coniothecium conglutinatum, Ranularia Gei, R. punctiformis.*

Although the present work is only a contribution dealing with a portion of the fungus flora of the Italian Alps, it seems now certain to the writer, that it can be safely affirmed, that the alpine fungus flora is characterized by a large predominance of perfect forms over imperfect forms, in comparison with the state of affairs in the plains. He thinks this fact may be logically explained by reference to the relative climatic conditions. In mountain and alpine regions, the long duration of the winters, together with the short summers, oblige the fungi which grow there to form winter fructifications early in the season, as they depend, in the majority of cases, upon this manner of propagation from year to year.

1574 - A Hybrid Wheat resistant to Rust.

RESISTANT PLANTS

GÉNIN, Ch. Les blés résistants à la rouille. Un hybride de Riéti. — *Journal d'Agriculture pratique*, 1912, Vol. II, No. 36, pp. 301-303, fig. 49-50. Paris. September 5, 1912.

The author proposed to obtain an awnless wheat and one which at the same time should combine all those qualities which confer value on Rieti. This latter, as is well known, escapes the attacks of rust on the one hand owing to its earliness, but is on the other hand exposed, in alluvial and fertile soils, to lodging, owing to the glumes with long awns which

readily store up the water of the slightest shower. Furthermore the chaff of awned wheat is difficult for animals to eat.

From a specimen of Rieti × Japhet, proceeding methodically and by pedigree breeding from one harvest to the other, the author obtained a hybrid which appears likely to answer the purpose he had in view: a fairly early wheat, beardless, adapted for the south-east of France. This wheat has preserved many characteristics of the common Rieti, *viz.* its general appearance, fairly long spikes with spikelets separated by glumes which by atavism still retain as it were a trace of the disappeared awn, and finally a very full long grain.

1575 - **Resistance of Hybrid Direct-Bearer Vines to Diseases.** — See above, No. 1534.

BACTERIAL AND FUNGOID DISEASES OF VARIOUS CROPS

1576 - **A Bacterial Disease of Stocks (*Matthiola annua*): *Bacterium Matthiolae* n. sp.**

BRIOSI, G. and PAVARINO, L. Una malattia batterica della *Matthiola annua* L. (*Bacterium Matthiolae* n. sp.). — *Rendiconti delle sedute della Reale Accademia dei Lincei, Classe di Scienze fisiche, matematiche, e naturali*, Vol. XXI, 2nd Half Year, Part 3, pp. 216-220. Roma, 1912.

Some varieties of stocks (*Matthiola annua*) possess considerable commercial importance, being cultivated on a vast scale, especially in several regions of Liguria, where they sometimes cover entire fields and supply abundant and splendid winter flowers, which are largely exported and form a source of not inconsiderable revenues to those regions.

During the last few years a serious disease has made its appearance on these stocks, and is making rapid headway and occasioning such damage that in some places the cultivation has had to be given up. The symptoms of the disease begin to appear on the leaves, where pale green blotches of blurred outline are formed, which are at first only perceptible by holding the leaves up to the light, when the contrast between their pallid green colour and the intense green of the remaining mesophyl of the leaf is seen. There next appear small brown spots of irregular shape and more or less dot-like, scattered over the limb of the leaf. Often the leaves, especially the young ones, become more or less deformed, do not attain the normal dimension and their margins curl upwards. The inflorescences are arrested in their growth and become distorted; the flowers consequently lose their commercial value.

The disease also attacks the leaves, the stem and the young branches, the woody elements of which become yellow or brown, being simultaneously filled with clotty black substances. The microscopical investigations made by the author on stocks collected on different occasions at Loano (Albenga) made it evident that in the cells of the diseased tissues there exist numerous mobile micro-organisms, isolated or in colonies; on the other

hand no trace of mycelium is found. From the cultures of the said micro-organisms in various nutritive media the authors constantly obtained the growth of a special bacterium which they regard as new to science and term *Bacterium Matthiolae*. In order to satisfy themselves that the disease was really due to the pathogenic action of this micro-organism, the authors infected some magnificent specimens of stocks with highly diluted broth of a pure culture. A few days later they in this way obtained the reproduction of the disease on the aerial parts of the plants sprayed, with the same characters as described on the specimens which had caught the disease naturally. The infection of the roots yielded a negative result, perhaps because it was needful to make a few preliminary lesions which it was impossible to carry out for want of suitable material. The authors were able to ascertain that the most usual path followed by the infection is that of the stomata.

1577 – ***Dothiorella Zeae* n. sp., Maize Pest in Cochin-China.**

FOËX and BERTHAULT, P. Une maladie du maïs en Cochinchine. — *Comptes-Rendus hebdomadaires des Séances de l'Académie des Sciences*, Vol. 155, No. 12 (September 16, 1912). Paris, 1912.

This is a description of a fungus disease which attacks maize in Cochin-China. The rachis of the spikes is greyish in appearance and tends to fall away into powder ; the several parts of the spikelets turn brown, while the caryopses enclosed in them remain healthy ; very often however the pericarp is blackened either at the base or higher up, over its whole length. Viewed in section the caryopsis very frequently exhibits a black zone corresponding to the pericarp, while the embryo and the albumen remain healthy. In very numerous other cases the contrary happens. On the pericarp, especially in the upper part of the caryopsis, there are observable small brownish blisters. Each of them represents a mycelial stroma which encloses the pycnidia of a fungus which the authors take to be the cause of the disease. As the parasite apparently forms a new species of *Dothiorella*, the authors propose to call it *D. Zeae*. Cultivated in the Laboratory the fungus did not fructify. Attempts at artificial infection of maize made with the mycelium cultivated in broth yielded negative results.

1578 – **A Fungus affecting Pastures in Manning River District, N. S. W.**

MARKS, G. in *The Agricultural Gazette of New South Wales*, Vol. XXIII, Part 8, p. 862. Sydney, August 1912.

A myxomycete, *Physarum cinereum*, has lately made its appearance for the first time on the grasses and clovers of the districts of the Manning and Stewart rivers. Sufficient data are, so far, not to hand respecting the effect of this myxomycete on the animals feeding on the infected plants.

The subsequent drought hindered the further development of *Physarum*, but the parasite is likely to appear again when the rains come.

1579 – A New *Exobasidium* Disease of the Tea plant.

ITO, S. and SAWADA, K. in *The Botanical Magazine*, Vol. XXVI, No. 308, pp. 237-241, figs. Tokyo, August 1912.

In the province of Siruga (Japan) the plantations of tea (*Thea sinensis* L.) have suffered seriously from a disease attacking the leaves when the latter are barely grown. In the districts of Abe and Ihara the first crop was destroyed to the extent of about 20 per cent.; some plantations in the same districts are so over-run that only a few young leaves remain completely immune. The same disease has also been found in a very widespread and serious form in the districts of Northern Formosa. The authors' view is that it is commoner than at present appears. Microscopic examination has made it evident that the cause of the disease is a species of *Exobasidium* differing in many respects from *E. vexans* Massee, which leads to the appearance of the well known " blister blight " on tea. The Authors, believing the species found by them to be new to science, gave it the name of *E. reticulatum*.

The first symptom of the disease is the formation of a small blotch, pale yellow in colour, on the upper face of the young leaf. Holding the blotched part of the leaf against the sun, the existence of a dark network is observed in its tissue. The blotches may be one or two to each leaf, with a contour not clearly defined, irregular in shape, gradually extending until they attain a diameter of 2 to 3 cm., and sometimes occupying the whole surface of the leaf. The colour of the blotches gradually changes from yellow to brown, and finally deep brown. The corresponding part on the lower face of the leaf on the other hand becomes first grey and as though sprinkled with powder ; then the dark network inside the tissue of the leaf becomes slightly prominent, until, breaking the epidermis, the characteristic white hymenium of the fungus appears outside. The hymenium gradually assumes the dark brown colour from the centre towards the periphery of the blotch. Finally the infected area of the leaf becomes dry and shrivelled.

1580 – *Macrosporium Sophorae* n. sp. and *Gibberella Briosiana* n. sp. injurious to *Sophora japonica*.

TURCONI, M. and MAFFEI, L. Due nuove malattie della *Sophora japonica* Linn. — *Rendiconti della Reale Accademia dei Lincei, Classe di Scienze fisiche, matematiche e naturali*, Vol. XXI, 2nd Half Year, Part 4, pp. 246-249. Roma, 1912.

During the summer and autumn of 1911, two perfectly distinct cryptogamic diseases developed on plants of *Sophora japonica* in the Botanical Gardens of Pavia. The first disease, which the authors term " vaiolatura delle foglie " (leafpox), is manifested by the appearance of rounded or circular blotches, small at first, which rapidly grow until they finally attain a diameter of 1 cm. On the upper face of the leaf these blotches have a central nucleus of dark walnut colour circumscribed by a broad

zone of lighter colour sometimes almost whitish ; on the lower face on the contrary they are black, owing to the presence of the very many fructifying organs of the fungus giving rise to the disease, and which the authors describe under the name of *Macrosporium Sophorae* n. sp.

The other disease, termed by the authors " seccume bianco dei rami " (white dry rot of the branches) is characterised by the appearance of livid elliptical aureoles lengthwise along the branch and sunken ; at their extremities the epidermis rapidly becomes whitish and rises and bursts in consequence of the breaking through of a number of small swellings, of a fleshy-waxy consistency and of a pale flesh-red colour, sometimes rounded, but mostly in the form of more or less elongated ellipses or even lines ; they often merge into one another and form longitudinal stripes amounting even to some centimetres in length. The aureoles then extend to the length of 5 to 15 cm. and a width of 10 mm. They often end by surrounding the branch, invading more or less extensive portions of it, and the branches then exhibit whitened sections over which are scattered a large number of small pink swellings, with immune green patches interspersed. In the young branches the aureole of infection occasionally extends over the greater portion of the branch, or occupies the whole of it, making it dry and wither. The pink swellings represent the summer conidial stage (*Fusarium*) of the fungus producing the disease. The latter in this form, behaves as a true parasite, its mycelium invading both the bark tissue and the inside wood. The perfect ascophorous form, which the authors designate *Gibberella Briosiana* n. sp., developed on the contrary in the late autumn and winter on the dead branches, and only reached maturity in the following spring. When completely developed the compactly clustered stromata of the ascophorous form are found to be built up of a bluish hypostroma, towards the external periphery of which are found the perithecia, emerging more or less from the stroma.

1581 – *Microstroma Platani* n. sp. on the Leaves of *Platanus occidentalis*.

EDDELBÜTTEL, H. and ENGELKE, J. Ein neuer Pilz auf Platanenblättern, *Microstroma Platani* nov. sp.- — *Mycologisches Centralblatt*, Vol. I, Part 9, pp. 274-277, figs. 1-6. Jena, September 15, 1912.

At the end of June 1912 some diseased leaves of plane (*Platanus occidentalis*) were sent from Hildesheim (Germany) to the Botanical Institute of Göttingen.

The examination of the material sent showed that such leaves were the hosts, not only of *Gloeosporium nervisequum*, but also of another hitherto unknown fungus that the writers describe under the name of *Microstroma Platani* n. sp. It gives rise to the appearance of small roundish, greyish-white patches on both leaf surfaces. The new species has subsequently been found also in various stations at Hildesheim and Göttingen.

INSECT PESTS

GENERALITIES

1582 - **The Supposed Hibernation of the Larvae of *Lasiocampa (Bombyx) trifolii.***

FRITZSCHE, ARTHUR. Raupe von *Lasiocampa (Bombyx) trifolii* überwintert nicht. — *Entmologische Zeitschrift*, Year XXVI, No. 27, pp. 107-108. Frankfurt-on-Maine, October 5, 1912.

It has hitherto been supposed that the larvae of *Lasciocampo (Bombyx) trifolii*, which are injurious to clover and grasses, hibernate very early and remain on their host plants from the spring until June (according to some observers, from the autumn until June).

The writer's investigations over twelve years prove that these larvae do not hibernate. Researches made in Sxwitzerland, at various altitudes and in different climatic conditions, show that these factors have no effect upon the life-history of these larvae or upon their coloration. Everywhere, it is the eggs which pass through the winter, and everywhere the larvae pupate in June, while the adult insects mostly emerge in August.

MEANS OF PREVENTION AND CONTROL

1583 - ***Aspergillus flavescens* parasitic on the Apple Tent Caterpillar *(Malacosoma americana).***

GEE, WILSON P. and BALLARD, MASSEY A. *Aspergillus* Infecting *Malacosoma* at High Temperatures. — *Mycologia*, Vol. IV, No. 5, pp. 279-281, fig. 1. Lancaster, Pa., September, 1912.

In some experiments on the relation of temperature to the life-cycle of the apple tent-caterpillar (*Malacosoma americana* Fabr.), the writers found that the larvae die if subjected to high temperatures from a disease produced in them by *Aspergillus flavescens* Eidam. This suggested to the experimenters to try whether it was possible to produce artificial infection at the normal and higher temperatures.

Six larvae from a perfectly normal nest, together with sufficient food, were sprayed with a spore suspension and the other two kept as a control. The bottles were plugged with sterile cotton and placed in the same compartment of an incubator maintained at a temperature of about 37°C. A similar experiment was conducted at the normal outdoor temperature (21° to 27°C). At the end of three days all of the larvae in the sprayed bottle kept in the incubator were dead from infection with *Aspergillus flavescens*. The control specimens at the incubation temperature showed no sign of infection. In the case of the experiment conducted at outdoor temperature, none of the larvae, either sprayed or unsprayed, showed any signs of such infection.

A second series of these experiments was carried on with the same results as the first.

The fungus appeared first at the posterior fourth of the body and from this region progressed forwards. This seems to indicate that infection takes place from the germination of the spores taken into the digestive tract of the caterpillar along with its food. Favourable conditions for germination were found in the region of the hind intestine of the insect. The fungus gradually invaded the whole body cavity of the larva, which was filled with mycelium and spores, accompanied by an almost complete disintegration of cellular structures. This cytolytic action, coupled with interference with the respiratory processes of the insect, affords sufficient cause for its death.

1584 - ***Dactylopius* injurious to *Exocarpus cupressiformis* destroyed by a species of *Chrysopa*.**

FRENCH, C. jun. Destructive Scale Insects. Mealy Bugs (*Dactylopius*) destroyed by Lacewings (*Chrysopa*). — *The Journal of the Department of Agriculture of Victoria, Australia*, Vol. X, Part 8, pp. 485-486, figs. 1-3. Melbourne, August 1912.

The writer found mealy bugs (*Dactylopius*) to be very numerous on some specimens of the native cherry tree (*Exocarpus cupressiformis*). This white scale insect was present in such quantities, that it could be seen even from a distance by the white patches it formed on the trees at intervals. The injuries caused by the mealy bug destroyed the leaves. Some weeks after making his first observations, the writer discovered, on again examining the infected trees, that the scale insects had to some extent been destroyed by a neuropteron, the lacewing (*Chrysopa*). He recommends that the trees should be carefully watched and that the mealy bug should be controlled at once from the moment of its appearance by the application of emulsions of kerosine, benzol, etc.

1585 - **The natural Enemies of the Cotton Worm** (1).

GOUGH, LEWIS, H. in *The Agricultural Journal of Egypt*, Vol. II, Part I, pp. 1-3, plate I. Cairo, 1912.

According to the writer, although the Egyptian cotton worm (*Prodenia litura* Fabr.) is a widely distributed species, it does not appear to be known as a pest to cotton anywhere outside Egypt ; this is probably due to the fact that some of the insects which control the cotton worm are not found in this country. Several insects have, however, been found destroying the cotton worm, but they are not plentiful enough, or else do not breed rapidly enough, to act as an effective check.

The writer describes the following natural enemies of the Egyptian cotton worm and figures them on a coloured plate : *Calosoma imbricata*,

(1) See No. 1476, *B.* Oct. 1912. (*Ed.*).

the rover beetle (*Poederus* sp.), the gauze-wing fly (*Chrysopa vulgaris*), *Eumenes maxillosa* (in its turn often parasitised by another insect, *Stilbum amethystinum*) and *Polistes gallica*.

1586 - **Control of *Agrotis ypsilon* injurious to Potatoes in India.**

Note by H. L. DUTT, communicated to International Institute of Agriculture by the Director of Agriculture, Behar and Orissa.

The potato storing demonstration is being continued. It will be over in another month. Campaign against *Agrotis ypsilon* has been taken in hand since August. For the last twenty years or so, this pest has been causing damage to winter crop on about 15 000 bighas (5000 acres) of land in Mokameh ; the annual damage on the area being about 4 lakhs of rupees. Last year Andre Maire trap was found successful in catching both the male and female moths. Last year a crop worth about 1 lakh of rupees was saved by picking off the first brood of caterpillars and catching the moths before egg laying. This year a large number of traps are being used to catch as many as possible of the first coming moths. If necessary, the first brood of caterpillars would be picked off in time.

INSECTS INJURIOUS TO VARIOUS CROPS

1587 - ***Phytalus smithi*, a Sugar Cane Pest in Mauritius.**

VUILLET, A. Le ver blanc de la canne à sucre à l'île Maurice. — *La Sucrerie indigène et coloniale*, Year 48, Vol. LXXX, No. 11, pp. 253-255. Paris, September 11, 1912.

A part of the sugar cane cultivations in the Island of Mauritius is at the present time over-run by a beetle recently described by Arrow under the name of *Phytalus smithi*. The insect, which appears rather formidable, is of American origin ; not long ago it was found at Barbados in a sugar cane field.

The adult reaches a length of 15 to 18 mm. and a width of 8 mm. about the elytra. It is a light chestnut brown in colour, the head and thorax being perceptibly darker than the elytra. The adult insect remains all day in the soil at a depth of 5 cm. ; it emerges in the evening to feed in the leaves of various shrubs, particularly Libreria coffee ; it does not appear to cause any very great damage to the leaves of sugar cane. The female deposits its eggs preferably in light soils rich in humus.

The grub is whitish with a yellow head and black mandibles. The thorax is wider than the rest of the body. The dorsal surface of the anterior half of the abdomen carries small erect spines and longer recumbent bristles ; the spines and bristles also appear in the thoracic rings and at the posterior end of the body. When full grown the larva is about 25 to 30 mm. long and lies folded V-shaped 10 to 30 cm. below ground, where it gnaws the roots of the sugar cane and other cultivated plants, especially cotton, peas and cassava. It pupates within an earthen cell elliptical in shape. The life cycle occupies year.

In Barbados, *Phytalus smithi* has two natural enemies: an insect (probably *Scolia* [*Dielis*] *dorsata* F.) and a bird of the genus *Quiscalus*. The absence of natural enemies of *Phytalus* in Mauritius is perhaps the principal reason of the proportions to which this parasite has increased within a short time. To prevent the importation of this insect pest into Madagascar and Reunion, the author, taking into account the fact that *Phytalus* originates from the West Indies, suggests the complete prohibition of any importations of plants coming from that region or from Mauritius, and the subjecting to a careful examination of plants of other origins. Further, all the vegetable remains left on or in the ground after the harvest must be destroyed by fire. By deep tillage the grubs may be brought to the surface of the soil and are then collected to be destroyed by women or boys. This collection will be facilitated by planting, alongside the sugar cane, cotton, or again sugar cane or cassava. When the roots of these plants are invaded by the grubs they must be extirpated and wholly destroyed. The hunt for the adult insects must be carried out from nightfall until 10 p. m., by gangs equipped with lanterns, or during the day by refuge traps consisting of ditches filled with organic refuse or pieces of sugar cane, onto which the insects make their way in large numbers to pass the night. Finally it is necessary to effect the acclimatisation in the invaded zones of the natural enemies which render *Phytalus* practically inoffensive in its country of origin.

1588 – **The Aphides Attacking Ribes, with Descriptions of Two New Species.**
THEOBALD, FRED V. in *The Journal of Economic Biology*, Vol. 7, No. 3, pp. 94-116. 14 figs., plates II-III. London, September 30, 1912.

Until recently, only four species of aphides have been referred to as attacking the *Ribes* of Great Britain; *Rhopalosiphum lactucae* Kaltenbach; *Myzus ribis* L.; *Macrosiphum lactucae* Schrank. and *Schizoneura ulmi* L. To these must be added *Aphis grossulariae* Kaltenbach, which is very destructive, and two species new to science: *Rhopalosiphum brittenii* and *Myzus whitei*.

Rhopalosiphum lactucae and *R. brittenii* attack the lower surfaces of the leaves at the top of the shoots, which become curled and bent; and sometimes these become so dense, that the apterae feed on the shoots and produce a certain amount of contortion. The *Macrosiphum, M. lactucae*, lives in a similar way, but the damage it does is not sufficient to prevent the subsequent growth of the shoots. *Myzus ribis* is mainly found on the under-sides of the larger leaves, living in the concavities of red, yellow or green blisters, which are not due to the aphides. The attack of the *Myzus* is not, as a rule, serious, as the growing-points are not injured to any great extent and they never seem to touch the wood. *Rhopalosiphum lactucae* also occurs under the red blisters on the leaves. *Aphis grossulariae* Kal-

tenbach lives in dense colonies on the tender young leaves and on the top of the shoots, causing the shoots to cease growing and the leaves to curl downwards. The growth of the bushes is often so much checked that they are ruined. *Schizoneura ulmi* L. lives on the roots of all currants and also on gooseberries, to which it often does a good deal of damage.

These aphides do not pass the whole of their life-cycle on currants or gooseberries, but migrate to other cultivated or wild plants. They are attacked by various natural enemies, but it is not possible to rely much upon these.

After giving a minute description from a systematic standpoint of the seven species which have been mentioned, the writer turns his attention to the means for their control. A great deal of good may be done by autumnal spraying to kill the oviparous generation. As there is no efficacious method of destroying the ova of aphides, it is well to kill the insects before they become sexually mature. The writer found that by spraying with paraffin jelly in the first week of October, the attack of the species which winter on the ribes is much less next year.

Myzus ribis may speedily be cleared in spring with soft soap and quassia, or tobacco wash, or paraffin emulsion. *Rhopalosiphum lactucae* and *Myzus whitei*, if taken in hand at once, may be checked by the same method, but if once the leaves are curled, spraying does but little good. The main thing with these three species is to get the nozzles well under the bushes and give them a good washing. With *Aphis grossulariae*, no spraying has any effect, as the leaves, owing to the attacks of the insect, are too closely packed. The best thing is to send women round with tins of paraffin emulsion and dip each tip well into the tin. In order to check *Rhopalosiphum lactucae* and *Macrosiphum lactucae* all lettuces near or in the gardens should be destroyed before the end of September. It is certain that *Schizoneura* cannot be stamped out on the elms, but the winged migrants may be kept off the ribes by spreading vaporite, for example, on the soil. The writer had excellent results with this insecticide.

1589 – *Aspidiotus bavaricus* n. sp. on *Calluna vulgaris* and on *Erica Tetralix.*

LINDINGER, L. Nachtrag zu den Beiträgen zur Kenntnis der Schildläuse usw. II. Extract from *Zeitschrift fur wissenschaftliche Insekten-biologie*, New Series, Vol. VIII, Part 1, 1 p. 1912.

A systematic description of a new species of *Aspidiotus* (*A. bavaricus*) previously determined as *A. ostreaeformis* by the writer and found for the first time in Bavaria on *Calluna vulgaris* and on *Erica Tetralix.*

The present distribution of this scale is as follows : in the neighbourhood of Harburg-on-Elbe on *C. vulgaris* and on *E. Tetralix* ; in Bavaria, Hesse Nassau, Styria, Norway, on *C. vulgaris* ; probably also in England

and Portugal, where it has been given the name of *A. ostreaeformis*. The species is certainly very widely distributed.

1590 – **An Acarid Pest of the Lime Tree: *Tetranychus tiliarum?***

BOUVIER. La maladie du tilleul. — *Bulletin des Séances de la Société nationale d'Agriculture de France*, Vol. LXXII, No. 7, pp. 658-660. Paris, 1912.

The Author records the serious damage wrought by an acarid, probably *Tetranychus tiliarum* Hermann, to the lime trees in the avenues of the park of Maisons-Laffitte near Paris. The first signs of the disease made their appearance shortly after flowering. On the lower branches of the trunk, all cut to the same height, the leaves very quickly assumed the yellow autumn tint and easily fell off. The yellow colour then gradually spread to the higher branches until it reached the tops of the trees. The leaves affected showed sometimes, particularly on their lower face, thousands of individuals of the acarid.

In a garden a good distance away from the infected avenues, *Tetranychus* has already begun to make its inroads. At Poissy, on the other hand, the limes appear to be still immune ; not so those of Saint-Germain, where on the 23rd July the author noted the existence of the infection, though less severe and widespread than that of Maisons-Laffitte.

The author's opinion is that the premature fall of the leaves is not such as to imperil the life of the trees attacked, but it certainly enfeebles them and in any case deprives them in summer of all ornamental effect.

As the acarid multiplies after the flowering and first attacks the lower branches, it is expedient to keep watch over these latter at the time of growth of the floral buds, and if the leaves harbour many individuals of *Tetranychus*, to have recourse to insecticide sprayings (nicotine, lysol, etc.). This will be found comparatively easy, as the lower part of the tree is one of the points to which sprayings can readily reach.

1591 – **Insects Injurious to the Cocoanut Palm.** (1)

ZACHER, F.: Notizen über Schädlinge tropischer Kulturen. I. Schädlinge der Kokospalme. — *Der Tropenpflanzer*, Year 16, No. 9, pp. 484-493, figs. 1-14. Berlin, September 1912.

The researches of Gehrmann in the Samoa Isles and of Froggatt in the Solomon and Fiji Isles have resulted in a new contribution to the information acquired by Preuss regarding the enemies of the coconut palm.

To the number of Coleoptera already recorded must be added : *Eurytrachelus pilosipes* Waterh. (Solomon Is.), *Alcimus dilatatus* Fairm. (Samoa), *Rhabdocnemis obscura* Fairm. (Solomon Is., Fiji, Samoa, etc.), *Olethrius tyrannus* Thoms. (Solomon Is. and New Hebrides), *Xixuthrus costatus* Montrz. (Russell), *Stenodontes insularis* Fairm. (Samoa), *Glyciphana*

(1) See No. 598, *B.* March 1912 ; No. 992, June 1912. (*Ed.*).

versicolor Fbr. (Samoa), *Caleipis femorata* Waterh. (Samoa). Information is still wanting as to the amount of damage caused by the five last-mentioned insects.

Amongst the injurious Orthoptera, *Graeffea cocophaga* Newp. (Solomon Is., Samoa, etc.) is mentioned. The other Orthoptera found in Samoa are *Anaulacomera insularis* Stäl and *Theutras pallidus* Walk. ; it is, so far, not known if these attack the coconut palm.

1592 - **Gipsy Moth Larvae injurious to Oaks in Spain.** (1)

AULLÓ, MANUEL. Notas entomólogicas. Una plaga de *Ocneria dispar* L. en los encinares de El Plantío y el Pardo. — *Revista de montes*, Year XXXVI, No. 854, pp. 551-556, 3 figs. Madrid, 1912.

Gipsy moth larvae (*Ocneria* [*Liparis*] *dispar* L.) have done much injury to the oaks of El Plantio and of El Pardo near Madrid, entirely defoliating them. The invasion of these larvae, popularly called " lagarta ", began in 1910. The injuries were observed early in April 1912, from which fact it was deduced that the larvae had appeared in the preceding month. The moths were seen towards the end of June. The spread of the moths seemed to be in the direction of the prevailing winds, from south-west to north-east.

Larvae collected on the spot early in July soon died, as they were attacked by parasites. The writer succeeded in rearing one of these, which he recognized as *Tachina festiva* Macq.

A good method of controlling the gipsy is to collect and burn the egg masses, or better, to smear them with plaster or clay to prevent the larvae hatching out.

INJURIOUS VERTEBRATES

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1593 - **The Garden-Dormouse *(Eliomys quercinus).***

MENEGAUX, A. Le Lérot. — *Journal d'Agriculture pratique*, 1912, Vol. II, No. 36, pp. 307-309, 1 col. plate. Paris, September 5, 1912.

This rodent is peculiar to the temperate regions of Central and Northern Europe ; it is wanting in Eastern Europe. It has been reported in Belgium, France, Switzerland, Italy, Germany, Hungary, Galicia and the Sieben Gegirge, as well as in the Baltic Provinces of Russia. It further lives in the north of Spain, but is not found at all in the British Islands. According to its different habitats this species presents modifications of form and sometimes of colour.

(1) See also No. 656, *B.* Feb. 1911; No. 1568, May 1911 ; Nos. 3023 and 3025, Aug.-Sept.-Oct. 1911 ; No. 1226, Aug. 1912. (*Ed.*).

The garden-dormouse is more partial to living on the mountains than in the plain and prefers broad-leaved forests; nevertheless in Switzerland and in the Harz, where it is exceedingly frequent, it is often found in the conifer forests. It is observed both near glaciers and, on the other hand, often in the thickets, in gardens, near dwellings and according to Brehm it likewise makes its way into the houses in search of fat, butter or milk. It sleeps during the day; during the night, wandering on the trees, it devours eggs, nestlings, and even small birds.

Garden-dormice are very destructive in orchards; late fruits are alone spared because the animals often pass into the lethargic stage before they are ripe. In an orchard, a single garden-dormouse can destroy the entire crop of the most luxuriant espaliers. The ripest and most select peaches and apricots are attacked by preference; in order to make quite sure which fruit it will devour, it gnaws into a large quantity which it thus destroys before they have become ripe.

The best means of defence against this rodent consist in the use of fine metal gauzes spread before the espaliers of the fruit plants, or in suitably disposed traps.

The garden-dormouse furthermore has effective natural enemies in cats, martens, weasels and the barn-owl.

ALFREDO RUGGERI, gerente responsabile.

INTERNATIONAL INSTITUTE OF AGRICULTURE

BULLETIN OF THE BUREAU OF AGRICULTURAL INTELLIGENCE AND OF PLANT-DISEASES

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THE INTERNATIONAL INSTITUTE OF AGRICULTURE

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(*b*) Communicate to parties interested, also as promptly as possible, the above information.

(*c*) Indicate the wages paid for farm work.

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(*e*) Study questions concerning agricultural co-operation, insurance, and credit in all their aspects; collect and publish information which might be useful in the various countries for the organisation of works connected with agricultural co-operation, insurance and credit.

(*f*) Submit to the approval of the Governments, if there is occasion for it, measures for the protection of the common interests of farmers and for the improvement of their condition, after having utilized all the necessary sources of information, such as the wishes expressed by international or other agricultural congresses, or by congresses of sciences applied to agriculture or agricultural societies, academies, learned bodies, etc.

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The information contained in some of the abstracts dealing with Canada has been most kindly placed at the disposal of the Institute by the Government of the Dominion.

The Canadian abstracting is by Mr. T. K. Doherty, chief of the Canadian Bureau of Correspondence with the International Institute of Agriculture.

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NB. The Intelligence contained in the present Bulletin has been taken exclusively from the periodicals, bulletins, and other publications which have reached the Library of the International Institute of Agriculture in Rome during the months of October and November 1912.

The Bureau assumes no responsibility with regard to the opinions and the results of experiments outlined in the Bulletin.

The Editor's notes are marked (*Ed.*).

FIRST PART

ORIGINAL ARTICLES

The Use of Artificial Nitrogenous Manures in Austria

by

FRANZ W. DAFERT

Director of the Imperial and Royal Experiment Station for Agricultural Chemistry of Vienna.

The advances of technique in the methods of manufacture of substitutes for nitrate of soda, the natural supplies of which, though large, are not inexhaustible, namely calcium cyanamide and nitrate of lime ("Norgesalpeter"), have naturally aroused the greatest interest in the Austrian agricultural world. It is well known that the reputation of useful new inventions usually spreads faster than the means of turning them to practical account, so that it is not a matter for surprise that years have elapsed before the new manures have come to be employed in the regular routine of practical agriculture. To this delay two causes have chiefly contributed, which though of different origin, have exercised an equally strong retarding influence : the difficulties attendant upon the initial stages of a new manufacture and the well-known conservative spirit of the purchasers. Besides this, the great distance of the places of manufacture and the not infrequent absence of well-regulated commercial organisation has retarded, and even prevented, the sale of the product. In this respect, it is only necessary to mention that, as has been explained by me in the *Zeitschrift für das Landwirtshchaftliche Versuchwesen in Oesterreich*, 1912, p. 107, the economic condition of the new industry was, at the beginning, somewhat unsatisfactory. Further, before 1909 there were practically insuperable hindrances in the way of obtaining calcium cyanamide in Austria, due on the one hand to the absence in this country of any factory capable of producing it, and on the other, to its being an item new to both railway and customs tariffs ; the results of the latter circumstance were that the duty levied on the new foreign product was excessive and the freight charges were heavy and out of proportion to the economic value of the article. But later, when the market was supplied to the extent of being able to satisfy the slowly increasing

demands for this product, and when the freight and customs dues had long been settled, still no regular sale ensued. What was needed was the unremitting propaganda on a large scale, like that, for instance, to which basic slag owed its great success. Another hindrance arose in the fact that each new fertilizer has certain properties which can only be observed and learnt from many years' practical experience. This circumstance was not sufficiently reckoned with at first and much harm was thus done. Unwise advertisement contributed to the failure, as it had often an unfavourable effect upon the Austrian farmers, who are cautious by nature.

Since then, a considerable improvement is noticeable in these respects. Certain technical improvements and the cheaper rate at which the necessary capital can be obtained, combined with the production of the commodity by large and favourably situated factories, and with greater unity in the general direction and other favourable circumstances, have strengthened the industry to such an extent that, assisted by a fortunate rise in nitrate of soda, it begins to acquire a firm basis, and while on October the 1st 1911, one kilogram of nitrogen cost 122 ½ pf., it now fetches 144 pf. f. o. b. at Hamburg.

From this date, nitrate of lime, for which the demand is steadily increasing, has had a ready sale in Austria. This is due both to the tariff regulations, which have been formulated by the Austrian Government in the interests of agriculture, and to the Norwegian Commercial Attaché, who has personally taken part in the propaganda. A decree has applied to nitrate of lime, used for fertilisers, the tariff No. 652 for chemical fertilisers introduced free of tax ; it also benefits by the railway facilities granted to fertilizers. Further, measures have been taken to instruct farmers in its use (it is, however, so similar to nitrate of soda that no special exertions in this direction are required) and to ensure that orders shall be promptly executed.

While in 1911, the amount of nitrate of lime used throughout the whole of Austria was very small, in 1912, 1500 tons have been sold. A very good sign is to be found in the large orders already given for 1913, which are said to amount to three or four thousand tons. The sale price on October the 1st. 1912 was 125 pf. per kg. (12*s.* 4*d.* per unit) of nitrogen f. o. b. Hamburg or 157 heller (13*s.* 3*d.*) for the same shipped to Tetschen. The question of the analytical control is not yet settled. The factories, it is true, accept the analyses of the Austrian Stations, while they do not allow the validity of samples taken by the receiver, but only of those taken by the sender. Numerous practical manuring experiments, carried out in 1912 by the Imperial and Royal Experiment Station for Agricultural Chemistry of Vienna in collaboration with some other Experiment Stations in the Empire, showed that the fears first entertained as to the excessive hygroscopicity of the new manure were without foundation. The only mis-

giving entertained by the farmers is lest there should not be sufficient quantities of nitrate of lime to be obtained at a paying price.

The trade in calcium cyanamide developed quite differently. The "Società anonima per la utilizzazione delle forze idrauliche della Dalmazia" produces at Sebenico at the present time about 6000 tons per annum. A second factory belonging to the same society at Almissa will be opened during 1913, and its output will amount to about 10 000 tons. There can thus be no fear that the available quantity of this product will be insufficient at present. Also, the tariff hindrances were, from the beginning, less in the case of calcium cyanamide, since it was at once placed in the category of fertilizers. On the other hand the Austrian farmers showed themselves much less disposed to buy cyanamide than nitrate of lime, as the former was the greater novelty to them. Overcoming the prejudices of the purchasers demanded therefore more sacrifices in this case. These sacrifices took the form of low prices and material assistance accorded to experiments undertaken for the purpose of overcoming the technical difficulties in the way of using cyanamide in practical agriculture. In 1912, thanks to temperate, but persistent and efficacious efforts on the part of the commercial world, and also to the above-mentioned condition of the nitrate of soda trade, the use of cyanamide has greatly increased in Austria. The consumption has been about 5000 tons, which was chiefly supplied to large estates, at prices tending to rise slightly: from 124 to 134 heller per kg. (10*s.* 6*d.* to 11*s.* 4*d.* per unit) of nitrogen, carriage-paid to its destination, sack included. According to the reports sent to the Vienna Agricultural Station, the action of cyanamide, when not used as a top-dressing, was unanimously approved, but there were complaints from all sides of the difficulty in spreading it; this must not be done by hand, or by barefooted labourers. Machine sowing can, however, be employed, and cyanamide can be mixed as required with neutral fertilisers, such as basic slag or kainit, and thus the spreading difficulties do not appear to be insurmountable. So far, the analytical control of cyanamide has given rise to no complaints; the factories have apparently adopted the usual procedure followed by the other branches of the fertilizer trade in Austria.

From all that has been said, it results that so long as the price of nitrate of soda remains the same as it is at present, the future of the young industry is assured. If, on the other hand, this price again suddenly falls, the new enterprise will be called upon to prove its powers of resistance. We may hope, from the progress already made, that the trade has acquired a sufficient footing to be able to support any extra burdens which threaten it. These facts are eminently satisfactory from the agricultural point of view. Naturally, the total substitution of nitrate of lime and calcium cyanamide for nitrate of soda is, at present, not to be thought of, the supply

of the new fertilizers being quite insufficient for this purpose. But an important step has been gained, inasmuch as a portion, at least, of the growing needs of nitrogen can be supplied, which means that the reserves of nitrates will be less drawn upon. The idea, however, that nitrate of lime and cyanamide can ever play the part sometimes assigned to them of regulating the price of nitrate of soda, is rather Utopian. Hitherto, on the contrary, it has been the price of nitrate of soda which has influenced those of cyanamide and nitrate of lime, and this will no doubt continue for many years.

No synthetic nitrogenous manures except cyanamide and nitrate of lime have so far made their appearance on the Austrian market. The farmers of that country are awaiting with interest the much talked-of novelty, Serpek's aluminium nitrite.

The Present Condition of Horse-Breeding in Hungary

by

Baron JULES PODMANICZKY

Sectional Ministerial Councillor, Sub-Director of the Horse-breeding Section of the Royal Hungarian Ministry of Agriculture.

Horse-breeding occupies a very important position in the agricultural policy of the Hungarian Government, alike from the number of horses existing in Hungary, from the progress recently made and from the special interest which has always been paid by the Government to this branch of public economy in the past and particularly during the last few decades.

Statistics. — According to the last census, the number of horses in Hungary amounts to 2 001 399, *viz.* 18 per square mile.

Comparing these figures with those supplied by other countries we find that there were in:

1. Germany (census 1907)	4 345 043,	or	20.7	per sq. mile.
2. Hungary (excluding Croatia, census 1911) .	2 001 399	»	18.4	» »
3. United Kingdom (census 1911)	2 023 711	»	16.6	» »
4. France (census 1909)	3 236 130	»	15.5	» »
5. Austria (census 1910)	1 802 748	»	15.5	» »
6. Russia (census 1910)	22 696 000	»	11.7	» »
7. Italy (census 1908)	955 878	»	8.5	» »

These data show that Hungary occupies the second place among these countries as regards the number of horses to the area.

Taking the proportion of horses to the population, Hungary occupies a still higher position, as there are 110 horses per 1000 inhabitants, as compared with 67 and 63 in Germnay and Austria respectively.

In 1895, the number of serviceable horses in Hungary amounted to 1 972 900; but the census of 1911 returned 2 001 399, that is an increase of 28 499. This increase was effected, moreover, at a time when agricultural conditions were unfavourable to horse-breeding. In 1911 there were 9 326 stud stallions and 919 671 brood mares.

The increase in the number of horses in Hungary has always kept pace with the exportation of horses from that country. Thus, in 1911, 62 551 horses worth 38 625 690 crowns (£1 609 400) were exported, giving an average price of 617.15 crowns (£25 14*s.* 3*d.*) per head. This is a very high figure, considering that many of the horses exported were foals of 1 to 2 years old, and some were for slaughter. It may be said that the more horses are exported, the larger is the number and the better the quality of the animals bred in the country.

The development of horse-breeding in Hungary has gradually led to the introduction of Thoroughbreds into all the Trans-Danubian districts, into the South and into the regions which are rather hilly than mountainous. In the sandy and less fertile districts, the Arab horse predominates, while stallions from the Karst are preferred in the Carpathian mountains. On the borders of Austria and Croatia, heavy stallions are the favourites, as they best suit the kind of animal which is produced in these countries.

Official action for the encouragement of horse-breeding. — The control of the national horse-breeding is centralised in the Royal Hungarian Ministry of Agriculture ; it is exercised by a special section of this Ministry and by the chief of this section, who directs and administers all matters connected with the staff and the National Breeding Institutes (breeding studs and depôts) and those relating to horse-breeding generally in the country.

The Staff of the National Stations of Horse-Breeding has a military organisation and ranks with the Royal Hungarian National Defence (Honvéd).

The Government has at its disposal the following institutes and stations for the control of horse-breeding in Hungary :

1) The four national breeding studs (Kisbér, Bábolna, Mezöhegyes and Fogaras).

2) The four national stallion depôts (Székesfehérvár, Nagykörös, Debreczen and Szepsiszentgyörgy).

3) Purchase for the State of mature stallions. Breeders are invited every year, in June, to give notice of any stallions they may have for sale, which are at least 3 years old, and not over 8. Such stallions are at once examined by the Delegate of the Ministry of Agriculture, and those which are considered good are bought for the national depôts. Further, a sale of stallions is held every autumn at Budapest, when the State buys especially English Thoroughbred stallions that have taken part in the races.

4) In order to supply the requirements of the stallion depôts, the State has made arrangements with the owners of private studs that they shall sell to the State at a moderate price any stallions bred in their stud,

which on reaching the age of 3 years, have been examined and approved by the delegates of the Government. The average price is fixed according to the value of the stock of the breeding stud.

5) In order to ensure good stallions, especially to the Communes, the Government buys yearly about 350 young colts from large and small breeders . These animals are kept till 3 years old at the depôt for colts, which has been established on the estate of the Public Treasury at Bukin-Palanka. The horses collected there are sold to the Communes at moderate prices and under advantageous conditions, with the understanding that the Communes are obliged to keep them for a certain number of years.

6) The stallions withdrawn annually from the active service list of the depôt, either on account of their age or for any other reason, but which are still good for breeding purposes, are sold on the spot to breeders at very moderate prices.

7) The supernumerary mares of the national studs are sold by auction to bidders who can substantiate their claim to the title of horse breeders.

8) The Government annually places a certain sum at the disposal of the authorities for horse shows arranged in various towns.

9) The Government gives material assistance to horse shows and provides prizes and diplomas.

10) Seeing that certain Communes are forced by agricultural conditions to restrict their grazing area, the Government gives annual assistance to Communes, Co-operative Societies and Associations which prepare and maintain common grazing land for the purpose of systematic colt rearing.

11) The Government grants assistance and gives a considerable sum in prizes to associations which are interested in organizing races. We shall return later to this question.

12) Systematic breeding in certain stud stations belonging to the State.

Types of breeding. — Horse-breeding in Hungary is divided into three types :

a) State breeding, which is, so to say, the support of the breeding carried out throughout the whole country (Studs and National depôts ; breeding on certain State properties).

b) Breeding in private studs. The latter are expected to supplement the efforts of the national studs, in the interests of breeding in general.

c) Breeding in general by the whole nation ; this branch derives its vital strength from the two preceding types and produces the great bulk of the animals.

State Breeding.

The National Studs of the Kingdom of Hungary.

The work of these establishments is the production of pure-bred first-class stallions for the benefit of the breeders of the country. These stallions are distributed among the different depôts. The system of breeding has been maintained for forty years on the principles originally established. In each national Stud, special care is taken that the brood mares are thoroughly tested. This is done in three ways : 1) the young mares are tried before being classed, also as saddle horses, if they belong to a breed used for riding purposes ; 2) they are subjected to a driving test, which is followed by one of the races regularly held in the studs ; 3) a certain number of young mares are lent for the season's hunting. Every year, also, some are sent to the military riding schools ; after being trained, these follow the School's pack of hounds during the hunting season.

The young stallions at 3½ years, which are taken into the national studs and sent to the stallion depôts, are, on account of their age, not tested ; but when they are turned 5 their powers are tried, either in the hunting field, or at a military riding school.

All these measures are adopted with the object of only reserving for breeding purposes animals which have given evidence of their qualities.

1. *The Royal Hungarian Stud at Kisbér.* — This stud, founded in 1853, is situated on an estate of the same name belonging to the Public Treasury, which is about 13 600 acres in extent. From the beginning, this establishment had for its aim the breeding and acclimatization of English Thoroughbreds. The animals bred were obtained, when the stud was founded, from the military and royal studs of Bábolna, Mezöhegyes, Piber and Lipizza. The importation of English blood began in 1854 with the purchase of 7 mares and 6 stallions, all Thoroughbreds. In 1860, a training stable was founded at Kisbér to test by public racing the colts bred at the stud. This establishment was suppressed in 1867; and the yearling colts are instead sold by auction, under the formal condition that they must not be sold out of the country without the express permission of the Minister of Agriculture.

After many other importations, Buccaneer, foaled in 1857, out of Eclot Little Red Rose by Wild Dayrell (Ton—Ellen Middleton), was obtained from England in 1865. This stallion was used for service at Kisbér during 21 years ; amongst its progeny were nine winners of the Austrian Derby, including the celebrated Kisbér, who also gained the English Derby in 1876 and the Grand Prix de Paris.

In 1872, Cambuscan was purchased in England ; this stallion was a dun, out of Arrow-Slane by Newminster. Cambuscan showed wonderful

breeding qualities, since in 1874 he got, out of Ernö Blaskovich's Waternymph, the invincible mare Kincsem, which was the most renowned Hungarian racer.

Amongst more recent importations, should first be mentioned Bona Vista (Bend Or—Vista), whose celebrated offspring Cyllene, a very valuable sire, was foaled in England. Bona Vista obtained remarkable results in producing Hungarian Thoroughbreds. The purchase of the stallion Adam (Flying Fox—Amie) must also be remembered.

The number of serviceable Thoroughbred mares is 20 + 181 = 201, and the total number of horses amounts to 694. The stud also takes special brood-mares to be served by Thoroughbred stallions at a corresponding service fee and the cost of their keep. The number of such mares is from 250 to 300 a year.

2. *The Royal Hungarian Stud at Bábolna.* — This stud, established in 1790, is situated on an estate of 8650 acres belonging to the Treasury. It is devoted to the breeding of pure-bred and half-bred Arabs. To increase the number of the pure-bred animals and also to introduce fresh blood, importations have been made from the East from time to time, as in 1836, 1843, 1854, 1876, 1897, and 1901.

The Bábolna stud occupies a very important position in the national breeding industry, since the excellent qualities of the Hungarian horse are attributed principally to the oriental blood in its veins. The stallions of this descent, which are rather large, are sent to the flat districts of the country, where agriculture is more advanced, while the smaller stallions are used in the mountainous regions.

The Bábolna Stud achieved a brilliant success at the Horse Show held in Paris at the time of the Exhibition in 1900. The stallion Kohailan, a half-bred Arab bred at this stud, gained the title of "Grand Championnat" as being the best half-bred stallion.

In this stud four pure-bred stallions imported direct from the East, and six half-bred Arabs are standing at present. Mares belonging to private individuals are admitted. The total number of brood mares is 182, 45 pure Arabs and 137 half-bred Arabs. The total number of the stud animals is 732.

3. *The Royal Hungarian Stud at Mezöhegyes.* — This stud, established in 1785, is on an estate of the same name covering 3 700 acres and the property of the Public Treasury. At its foundation, it possessed 172 Circassian mares, 148 Holsteins and 177 Moldavians. In the course of time, this stud has suffered many changes, but the animals bred have been always equally strong, bony, and well-built. These characteristics and exceptional qualities are largely due to the particularly favourable soil at Mezöhegyes, owing to which an Anglo-Norman stock has been reared

at this stud ; to this breed belonged Grand Nonius and Petit Nonius, whose achievements have redounded to the credit of Hungarian national breeding.

With regard to the present position of horse-breeding in Hungary and to the present history of the Mezöhegyes stud, the purchase of four stallions was of particular imoportance. In 1816, 10 stallions were carried off by the Hungarian troops from the Rossieri (France) stud and brought to Hungary. Amongst these was the English Thoroughbred Orion, foaled in 1810, whose sire was Nonius Senior and whose dam was a Norman mare. This stallion was the ancestor of the present Nonius race. He reached an exceptional age and stood at the stud for 22 years. The second stallion which played an important part in the history of the Mezöhegyes stud was Furioso (Breveteer—Miss Jury), an English Thoroughbred purchased in 1841 from the stud of Count George Károlyi. The third stallion was Northstar (Jacques Tauchton—Ringlet), a Thoroughbred imported from England in 1852. The two last-named animals were the founders of the English half-bred families " Furioso " and " Northstar," which still exist. In the fourth place, we mention Gidran I, an Arab stallion, the founder of the " Gidran " family.

At the present time, the Mezöhegyes stud is divided into five groups, *viz.* :

1) The descendant of Furioso and of Northstar. Half-bred English stud.

2) " Gidran " family stud. Anglo-Arabs, dun mares.

3) " Grand Nonius " family.

4) " Petit Nonius " family.

These last two belong to the same race, but are divided into two studs according to their height. Seeing that for a long time the mares in each of these studs have been served by English Thoroughbred stallions, as well as by stallions of the same descent or belonging to the stud itself, the whole stock has been practically transformed into English half-breds.

5) Lipizza Stud ; the mares of this stock were introduced from the national Fogaras stud for experimental purposes.

In the first four groups English Thoroughbred stallions, as well as those of the same family, are used ; but great care is used in mixing the blood, so that the original character of the family should not be lost by excessive mating with English Thoroughbreds.

In this respect, special care is taken with the " Nonius " race. The stallions of this race are all strong and handsome. The horses of this race are universally liked and preferred to all others as draught horses for farm work.

The Lipizza stock was transferred to Mezöhegyes with the object of improving the race, which is useful in many districts of the country,

by means of the developing influence of the Mezöhegyes soil and in the hope of producing stronger stallions.

The following stallions are at present standing in this stud :

5 English Thoroughbreds and 3 Anglo-Arabs for the " Gidran " family.
2 " Furiosos " for the half-bred English stud.
6 " Noniuses " for the stud of this name.
3 " Lipizza " stallions.
Total 19 stallions.

Brood mares :

Half-bred Stud	142
" Gidran "	100
" Grand Nonius "	141
" Petit Nonius "	139
" Lipizza " Stud	24
Total	546

4. *The Royal Hungarian Stud at Fogaras.* — This stud is situated on the estate of the same name, which is State property and covers nearly 10 000 acres. It was established in 1875, for the purpose of producing Karst (Lipizza) stallions, thick-set, with plenty of bone, but quick-moving, suitable for the mountainous districts of the country. The stud stock was recruited occasionally from outside. The present brood mares are the descendants of the Favory, Maestoso, Napolitano, Pluto, Conversano, and Incitato families. The annual products of this stud are grazed on the mountain pastures. Eight stallions of Lipizza origin are now standing, while the number of brood mares in the stud only amounts to 53. The total number of horses is 332.

Thus, in the four national studs, breeding is carried on with a total of 982 brood mares.

The supernumerary mares, both old and young, of the four national studs, which are not quite all that is required but free from hereditary unsoundness, are sold by public auction on the premises of the studs, as was said above ; but only qualified breeders are permitted to bid. The rest of the supernumerary mares are sold each autumn by public auction at Budapest.

The stallions bred on the stud are distributed on reaching 3½ years of age between the State stallion depôts, whence at the age of 4 years they proceed to the service stations.

The State Stallion Depôts of Hungary.

The Kingdom possesses four stallion depôts, divided into 18 sections in all. At the head of each depôt and of each section is placed a chief, who looks after the breeding of horses throughout the district. Each

section of the depôt has the superintendence of the territory belonging to a certain number of counties. Each county decides once in the year upon the places (towns and communes) where service stallions are to be established, as well as upon the number and kind of stallions assigned to these stations.

The service fee of the stallions distributed amongst the service stations varies from 2 to 16 crowns (1s. 8*d.* to 13s. 4*d.*) according to the breed and quality of the stallions and the material conditions of the district; in some districts the service of the stallion is gratuitous. Some of the stallions used at the depôt are let out for the service season, at a fixed price, to breeders, who can keep the animals throughout the year.

The number of mares served by one stallion in a year may not exceed 45.

The heavy stallions necessary to supply the wants of districts where heavy horses are bred, are obtained either from the Ardennes stock managed by the direction of the Kisbér estate, or from abroad, especially from Belgium.

For the use of districts where heavy horses are bred, Belgian horses are raised; only stallions of this breed will, in future, be distributed to breeders in these parts of the country.

Stallion depôts exist at: 1) Székesfehérvár, 2) Nagykörös, 3) Debreczen, 4) Sepsiszentgyörgy.

On the whole of the ground covered by the four stallion depôts there were, during the recent service season:

a) at the 871 service stations	3021 stallions
b) let out to breeders	225
c) with private breeders	142
Total stock of stallions . . .	3388

The stallions of the four depôts have served 141 980 mares in all, an average of 47 per stallion.

Of the 3388 depôt stallions, 380 come from the Kisbér stud, 343 from Bábolna, 1026 from Mezöhegyes and 158 from Fogaras.

1258 mature stallions and 233 yearlings were purchased from private persons.

Horses reared on the Estates of the State Studs of Hungary, the Royal Estate at Gödöllo and the Estate of the Kolosztorda Stud.

The estate of the Mezöhegyes stud breeds the Nonius race for stud animals and draught horses. Its stock consists of 9 stud stallions and 178 mares; total, 737 horses.

The estate of the Fogaras stud rears the Nonius and Lipizza races for the same purposes. Its stock consists of 10 stud stallions and 34 brood mares ; total, 164 horses.

The Royal estate at Gödöllö produces horses of the Nonius race for the same ends. It uses 4 stallions and 88 brood mares ; total, 283 horses.

The estate of the Kolozs stud produces English half-breds, with 4 stallions and 55 brood mares ; total, 229 horses.

The Kisbér stud estate breeds heavy Ardennes, with 4 stallions and 91 brood mares ; total, 261 horses.

The estate of the Bábolna stud is devoted to the breeding of heavy horses, by means of crosses between the Murahöz and Ardennes breeds. Its total is 224 horses.

All the young stallions from the Mezöhegyes, Kisbér and Gödöllö studs are bought for the national stallion depôts.

The mares, with the exception of the brood-mares of the Kolozs stud, are used for farm-work.

Horse-Breeding in Private Studs in Hungary.

Private studs play an important part in the horse-breeding of the country. There are in Hungary about 420 studs belonging to private individuals and which contain about 13 000 brood mares. As regards the breeds, English Thoroughbreds are bred in 59 studs, English half-breds in 337, Arabs in 32, Noniuses and Anglo-Normans in 13, Trotters in 12, and Lipizza blood is to be found in 22 studs, while heavy horses (Belgians, Percherons, etc.) are bred in 19 studs.

The stallions used in the studs are divided in the following manner : English Thoroughbreds, 210 ; English half-breds, 168 ; Arabs, 17 ; Noniuses, 24 ; Trotters, 23 ; Lipizza, 18 ; heavy horses, 18.

Breeding in General.

Horse-breeding in general has undergone great changes of late years, not only on account of the decrease in grazing land, which is an unfortunate result of the growing intensity of agriculture, but also because intensive agriculture, by using a greater number of machines, requires stronger built and quieter horses. The horse-breeding map of the country has also been much altered lately. Formerly, large numbers of high-bred horses were reared in the Trans-Danubian districts ; at present the breeding of heavy horses is gaining ground at the expense of the breeding of horses of noble blood. Nevertheless, in proportion with the decrease of this branch of breeding, horse-breeding as a whole has increased, both as regards quantity and quality, in the districts between the Danube and the Tisza, as well as in Lower Hungary, so that these economic changes

have in fact only displaced the centre of intensive breeding from the western to the eastern districts.

With a view of hindering the expansion of heavy horses, the district devoted to their breeding has been defined, and outside of this it is not permissible to use heavy stallions in general breeding, exceptions being only made in the cases of some breeding societies, which are specially engaged in the production of such horses.

In the direction and administration of horse-breeding in our country, we keep three aims in view:

1) We do everything to make horse-breeding not only useful but a paying business. 2) We endeavour to provide farmers with the necessary number of draught horses suitable for farm work. 3) We reserve for the army a sufficient number of good horses.

Before closing our review of breeding in general, we should mention a co-operative society, which is showing very commendable activity — the Association for rearing horses of the Mezöhegyes district breed. This aims at producing by means of logical and systematic measures, a race of strong horses suitable for agricultural and other purposes. This object is the more important, in that the production of this type of horse, which is excellent for agricultural work, tends to hinder the breeding of heavy breeds in these districts, thanks to the exceptional qualities of the animals bred by this economically important Association.

The Association receives considerable assistance from the Ministry of Agriculture. It maintains 10 service stations (stallion depôts) with 120 stallions, which last season served 4916 mares belonging to 2819 breeders, giving an average of 41 mares per stallion.

Horse Races.

In accordance with the general tendency of the national breeding in Hungary, horse-racing has received efficient support, both material and moral, on the part of the Government and of private individuals.

The following data show the work done by the different racing societies during 1911.

The *Hungarian Horse Society* has organised, in 41 meetings, 275 flat races at Budapest and Alag and has given prizes to the value of 2 100 240 crowns (£87 510). The highest prize was the " King's Prize " of 125 000 crowns (about 5000 guineas). In these races 600 horses ran.

The *Association of Amateur Jockeys* organised 27 meetings at Alag, Pozsony and Siófok, with 158 flat and hurdle races and steeplechases ; several of them were reserved to amateurs. The total of the prizes amounted to 426 100 crowns (£17 750), the highest being 23 500 crowns (£980) offered at the big steeplechases at Alag. In these races 347 horses ran.

On the race-courses of the different provincial societies, 30 meetings have been held at 18 places ; there have been 66 level races, 27 hurdle races and 46 steeplechases. The total amount of prizes was 170 000 crowns (£7 080). In these 650 horses ran.

The *Budapest Trotting Race Society* organised, also in 1911, in 26 meetings, 187 races in which 306 horses were entered and with prizes of the total value of 535 800 crowns (£22 325). The highest prize was the "National Prize" worth 20 000 crowns (800 guineas).

The provincial societies organised 17 meetings at 7 places, and the amount of money given in prizes amounted to 151 200 crowns (£6 300).

The Royal Hungarian Ministry of Agriculture allotted in 1911 the following sums for the encouragement of sport and horse-racing: flat races, 377 700 crowns (£15 700) ; trotting races, 216 000 crowns (£9 000) ; long distance races, high-jumping and jumping races, 8 000 crowns (£330).

The Government obtains the money necessary for this purpose from the revenues from public betting; a certain quota of the sums paid in to the totalizers on the different race-courses returns in fact to the Treasury, which receives it from the Sports Society. The sums of money thus collected form a special fund devoted to the aims of national breeding.

Besides the help given by the Government, the "National Fund for Horse-Breeding" also actively assists in the work of breeding English Thoroughbreds. This fund is a gift made to Hungary by the King in 1860. The revenues of this fund are administered by a commission elected from the Hungarian Horse Society and are used to defray the expenses of the importation of excellent English stallions and brood mares, which are then sold to the breeders of the country. The present value of this fund is about 600 000 crowns (£25 000).

Analysis of Wines by a Physico-Chemical Volumetric Method

by

PAUL DUTOIT and MARCEL DUBOUX

Professors of Physical Chemistry in the University of Lausanne.

The physico-chemical method of volumetric analysis does not differ in principle from the ordinary method. In each case use is made of a titrating reagent which forms a definite compound with the constituent to be determined, and the point at which the reaction is complete is ascertained. Reactions which lend themselves to exact volumetric work with colour-indicators are not numerous. An indicator may fail if the solution to be analysed is itself coloured, if it is too dilute, or if other factors — a change in the medium, a subsidiary reaction, etc. — modify its colour-change.

We have shown that colour-indicators may advantageously be replaced by "physical indicators" such as electric conductivity, and that by this means volumetric analysis becomes a general method, since there are hardly any reactions between electrolytes which cannot be followed quantitatively. Precipitations, formation of complex bodies, saturations, substitutions, and reactions used for gravimetric analysis in general, can also be used for volumetric analysis, whatever the dilution of the solution to be analysed.

The technique of titrations with electric conductivity as indicator is relatively simple. It consists in adding to the solution under examination exactly measured quantities of a suitable reagent and noting the conductivity after each addition. Four or five additions of the reagent, or even a larger number, may be made successively according to the nature of the titration. The result of the operation is then found by calculation, or more simply by graphical means. The volumes of the reagent are marked off as abscissae and the conductivities as ordinates, and the points obtained in the experiment are joined up by a curve, either sketched in or calculated. We have given the names of *precipitation curves, saturation*

curves, and *substitution curves* to the curves obtained by graphical representation of precipitations, saturations, and substitutions examined by electric conductivity methods. When the curve shows one striking feature, this always indicates that the quantity of reagent to which this point corresponds has been sufficient to complete the reaction. In other words the abscissa of the point of inflexion represents the volume of reagent which has combined with the constituent to be determined.

It is at once seen that physico-chemical volumetric analysis differs from the ordinary method in that, instead of giving only the final point of the reaction as with colour-indicators, it gives a curve representing the whole course of the reaction and whose form may give further information. If the same reagent takes part in several reactions the curve will show this, and a single titration will give several analytical data.

As the object of this article is to give a summary of the results so far obtained by the physico-chemical analysis of wines, we will not discuss here the theories which must guide the analyst in the interpretation of the reaction curves, or the working details of the method, which consists essentially in the use of small burettes. We would refer anyone specially interested in this part to our various publications on the subject (1).

The constituents of wine which can be determined by physico-chemical volumetric analysis include those susceptible of determination by general analytical methods and others which have so far eluded precise determination. It will be well to begin by considering determinations of the first type, namely chlorides, phosphates, sulphates, lime, magnesia, tartaric, malic and succinic acids and ammonia.

Each of these determinations requires a single titration with conductivity as indicator; they are consequently quickly carried out. We have placed the curves characteristic of these determinations on the same plate, and give the following information as to the precision of the results and the reagents employed in the different determinations.

Curve I. Chlorides. — Normal silver nitrate is added direct to the wine. The end of the precipitation is very clearly marked, at A. The precision of this determination is 2 to 5 mgr. per litre, using 50 cc. of wine.

Curve II. Sulphates. — N/4 baryta is added to the wine. The end of the precipitation is at B, and the precision of the determination is a few centigrams per litre, using 50 cc. of wine.

Curve III. Sulphates. — The reagent here is normal barium chloride. The final point of the reaction is at C, and the precision is above 0.01 gr. per litre.

(1) See particularly: DUTOIT and DUBOUX, *L'analyse des vins par volumétrie physico-chimique*, published by Rouge, Lausanne.

Curve IV. Mineral phosphates. — The reagent is normal uranium nitrate. It is added, with certain precautions, to wine treated with alcohol. The inflexion is at D. Precision : 0.01 to 0.02 gr. of P_2O_5 per litre, using 50 cc. of wine.

Curve V. Lime. — The Ca is precipitated by adding to the wine a little sulphuric acid and excess of alcohol ; the sulphate is filtered, dissolved in water and titrated with normal potassium oxalate. End of the reaction at E. Precision : 0.01 to 0.015 gr. of CaO per litre, using 50 cc. of wine.

Curve VI. Tartaric Acid. — The reagent is N/4 baryta. The wine is treated with three times its volume of alcohol, 8cc. of glacial acetic acid, and 1 cc. of normal ammonia. The end of the precipitation is at F. Precision : 0.10 to 0.15 gr. per litre, using 30 cc. of wine. The content of sulphates must be already known for determining tartaric acid.

Curve VII. Tartaric Acid. — The reagent is normal barium acetate. The wine is treated with the amount of baryta necessary to precipitate the sulphates and with uranium nitrate ; it is then three-quarters neutralised with ammonia, strongly alcoholised and precipitated by excess of silver nitrate. The precipitate is dissolved in sodium chloride. An aliquot part of this solution, acidified with acetic acid and alcoholised, is used for the determination of tartaric acid, the rest for malic and succinic acids. Point of inflexion at G. Precision : 0.1 gr. of tartaric acid per litre.

Curve VIII. Malic Acid. — The reagent is normal barium acetate, which is added to the preceding solution in a neutral and alcoholic medium. Inflexion at H, after precipitation of tartaric and malic acids. Malic acid determined by difference. Precision : 0.20 gr. per litre.

Curve IX. Succinic Acid. — An aliquot part of the preceding solution is strongly alcoholised and treated with excess of normal barium accetate. It is titrated back with normal Li_2SO_4. Inflexion at K, giving the mount of Ba not used, and consequently the sum of tartaric + malic + succinic acid (precision 3 %). Succinic acid determined by difference.

Curve X. Ammonia. — The wine is defecated with baryta, and the filtrate distilled in presence of tin. Reagent $\frac{N}{10}$ HCl. Inflexion at L. Precision 2 to 3 mgr. per litre.

All these determinations have been carefully studied ; they will shortly be completed by the addition of those for magnesia and potash which can also be performed by this method, but which are still being studied, as the precision of the results does not seem sufficient yet.

The advantage of physico-chemical volumetric analysis for separate determinations of the constituents of wine lies in the quickness and the exactness of the operations. Up to the present no statistics of wines have contained, for instance, phosphates and malic and succinic acids, while even quantitative determinations of lime and magnesia are quite un-

usual; in future these constituents can be included in the appreciation of wines.

The time taken by complete analysis considerably hampers the analyst, so that we would specially emphasize the fact that all these determinations can be carried out by physico-chemical means in less than a day's work, so that they become accessible to control laboratories.

The new determinations which can be carried out by electric conductivity, and have not yet been managed by the ordinary gravimetric and volumetric methods, are strong acidity, feeble acidity, total acidity, total alkalinity and organic alkalinity.

Before describing the curves of the reactions which lead to these new determinations, it may be well to state what is determined, and also to define what chemists mean by total acidity and ash alkalinity.

By agreement, the term " total acidity " is used to express the amount of normal alkali (NaOH or KOH) which must be added to one litre of wine to bring about the change in colour of litmus (in some countries of phenolphthalein or even of the colouring-matter of the wine). Multiplying this number in cc. by the factor 0.075 or 0.049 gives the total acidity expressed in grams of tartaric or sulphuric acid respectively per litre. This determination is purely conventional. It does not correspond to the real acidity (sour taste) of the wine, which is given by the concentration of H ions — not necessarily proportional to the total acidity. In fact it does not correspond to the total of the free acids of the wine, that is, to the concentration in H ions which can be substituted by alkalis. It can easily be shown that at the moment when litmus changes colour the phosphoric acid of wine is present almost entirely in the form of mono-phosphates, the sulphurous acid is only half neutralized, the tannin is still free, and so on. It is consequently correct to say that the " total acidity " of a wine is a conventional determination. This does not prevent its having a considerable value, for it includes the chief free organic acids of the wine, the substances just mentioned being generally of little importance.

The alkalinity of the ash is a determination which has no precise signification unless carried out by Farnsteiner's method (a delicate process, as it entails elimination of the phosphates). It is the molecular concentration of the fixed mineral alkalis of the wine not combined with mineral acids, these being supposed to be entirely saturated.

We have been able to show that by physico-chemical volumetric analysis the determinations of total acidity and of ash alkalinity may be completed, giving results more definite chemically.

The curve for the neutralisation of wine by 5N soda (curve XI) shows an inflexion at M when the saturation of all the H ions capable of substitution is completed; this is (after a correction for weak alkalis, which need

not be discussed here) the true *total acidity* of the wine. The "total acidity" of chemists would be better called *strong acidity*.

A single curve from $\frac{N}{4}$ baryta (curve XII) gives an inflexion after precipitation of the sulphates (point N), a second corresponding with the colour-change of litmus (point O), and lastly another (P) giving the total acidity as we have defined it. The difference between the strong acidity and the total acidity gives the weak acidity, comprising principally the tannic matter of the wine.

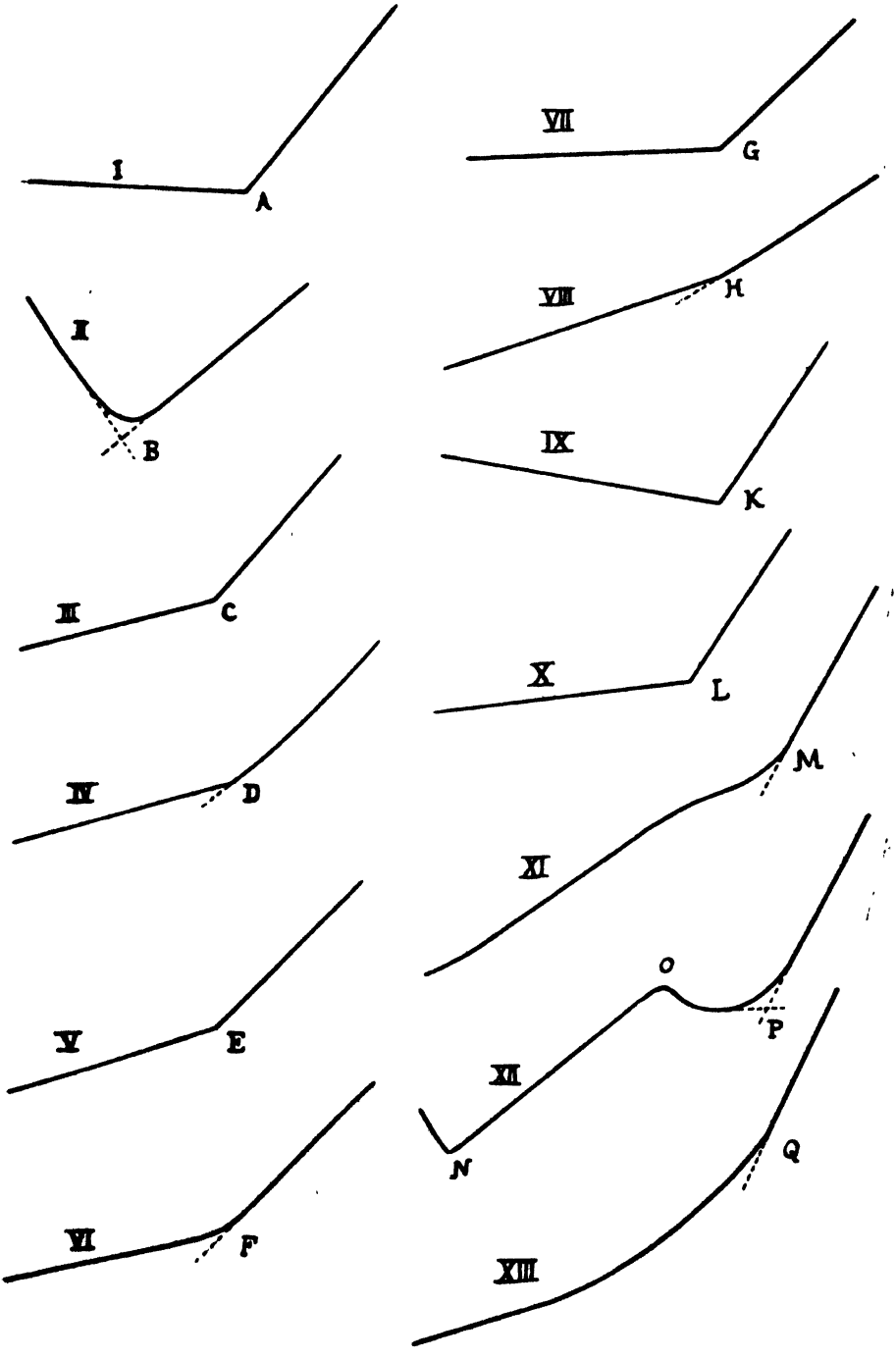
With regard to alkalinity, we have shown that the curves for the substitution of an alcoholised wine by normal lead nitrate (curve XIII) show an inflexion, Q, after substitution of all the bases combined with the organic acids. The examination of this determination has established that wines normally contain organic alkalis not detected by chemical analysis. The amount of these alkalis is given by subtracting the mineral alkalinity of the ash and the alkalinity due to ammonia from the total alkalinity as defined by us.

It remains for us to show what practical advantages may be expected from physico-chemical analysis of wines, as applied in the detection of adulterations. The insufficiency of chemical analysis is often due to the fact that statistics only give precise figures for a small number of the constituents, precisely those which may easily be added fraudulently owing to their low price. Adulteration would certainly be more difficult if the number of isolated constituents determined could be increased and especially if the substances which form the "body" of the wine and are not articles of trade could be determined.

The introduction of physico-chemical volumetric analysis seems to meet both these needs. The determinations of different constituents, being more quickly performed, can be made more numerous, and may also extend to bodies such as weak acids and organic bases which chemical analysis does not even detect. Naturally it will be necessary to collect abundant statistics of the normal contents of these new constituents before making them the subject of legislation. The analyses are still too few for us to attempt this at present. This work should fall to the œnological stations, which are better equipped for carrying it out than we are.

As an illustration, we give here the analyses of certain wines, carried out by the official Swiss method and by physico-chemical volumetric analysis (1).

(1) The determination of fixed alcalinity only has been made by Farnsteiner's method. To the value obtained has been added two-thirds of the phosphoric acid, expressed as normal cc. per litre. (*Authors' note*).


I
A
II
B
III
C
IV
D
V
E
VI
F
VII
G
VIII
H
IX
K
X
L
XI
M
XII
O
P
N
XIII
Q

	White wine Vaud 1910		Red wine Vaud 1909		Red wine Vaud 1906		Red wine France 1909	
	Chemical analysis	Phys.-chem. analysis	Chemical analysis	Phys.-chem. analysis	Chemical analysis	Phys.-chem. analysis	Chemical analysis	Phys.-chem. analysis
Conductivity	—	212	—	314	—	298	—	235
Specific gravity	0.9947	—	0,9971	—	0.9966	—	0.9953	—
Alcohol	10.5	—	10.2	—	10.8	—	9.95	—
Extract	20.8	—	25.6	—	26.2	—	20.6	—
Reduced extract	20.4	—	25.4	—	25.9	—	20.5	—
Reducing sugars	0.40	—	0.18	—	0.31	—	0.15	—
Mineral mater	2.03	2.05	3.15	3.07	2.84	2.95	2.32	2.24
Total acidity	—	149.0	—	134.0	—	126.2	—	144.0
Strong »	115.0	113.0	76.0	77.0	76.4	78.5	104.0	102.5
Weak »	—	36.0	—	57.0	—	47.7	—	41.5
Weak organic acidity	—	18.7	—	31.4	—	26.4	—	25.3
Fixed acidity	110.0	—	65.2	—	65.0	—	85.8	—
Volatile »	12.0	—	16.8	—	19.8	—	18.2	—
Total alkalinity	—	24.3	—	39.5	—	33.4	—	28.1
Fixed »	18.6	—	31.4	—	30.1	—	24.0	—
Organic »	—	5.4	—	7.3	—	2.4	—	3.1
Sulphuric acid	—	4.8	—	5.0	—	5.0	—	5.5
Hydrochloric »	—	0.85	—	4.34	—	2.8	—	1.15
Phosphoric acid (total)	15.0	—	20.9	—	16.7	—	12.3	—
» » (mineral)	—	13.7	—	18.7	—	15.9	—	10.3
Organic phosphorus	—	1.3	—	2.2	—	0.8	—	2.0
Sulphurous acid (free)	0.4	—	—	—	—	—	—	—
» » (total)	1.2	—	—	—	—	—	—	—
Tartaric acid	—	48.3	—	24.5	—	28.1	—	47.0
Malic » / Succinic »	—	27.0	—	22.2	—	19.6	—	
Magnesia	8.8	—	14.4	—	11.6	—	9.5	—
Lime	—	4.8	—	9.2	—	8.5	—	5.3
Ammonia	—	0.3	—	0.8	—	0.9	—	1.0

The analytical results are expressed in the following way:

1) Conductivity in reciprocal Ohm-cm. $\times 10^5$ at 25°.

2) Alcohol in volumes per cent.

3) Extract, reduced extract, reducing sugars, and mineral matter in grams per litre.

4) All other constituents in normal cc. per litre. This last method of expression, although not much used, is preferable to expressing the concentration of the substances in the wine in grams, as it facilitates comparison.

SECOND PART

ABSTRACTS

AGRICULTURAL INTELLIGENCE

GENERAL INFORMATION

LEGISLATIVE AND ADMINISTRATIVE MEASURES.

1594 - **Law relating to the Departmental and Communal Agricultural Instruction in France.**

Enseignement départemental et communal de l'Agriculture en France. — *Ministère de l'Agriculture, Bulletin mensuel de l'Office de Renseignements agricoles*, Year XI, No. 9, pp. 1159-1160. Paris, September 1912.

The law of August 21, 1912, relating to the Departmental and Communal Agricultural Instruction, published in the *Journal Officiel* of August 25, 1912, provides a Direction of Agricultural Services in each department, in place of the Departmental Chairs of Agriculture established by the law of June 1879. The work of this Direction includes: the popularization of agricultural knowledge, the teaching of agriculture in the establishments of public instruction selected by ministerial decree; the service of the economic and social interests of agriculture and of agricultural insurance and rural hygiene; agricultural information, statistics and food-supply; the direction of experimental fields; researches or technical missions and, in general, all the services to do with agriculture. The Veterinary and Forestry Services and the direction of Agricultural Stations are not included in these duties.

The Departmental Professor of Agriculture shall be entitled Director of the Agricultural Services; he is assisted by one or several agricultural lecturers, who hold special positions, whose sphere of work is variable and comprehends all or part of one or several arrondissements." These spheres may be extended still further in the case of specialists.

1595 - **The Decree of the Ministry of Agriculture of France for the Reorganisation of the Laboratory for Research on Infectious Diseases of Animals.**

Décret du Ministère de l'Agriculture réorganisant le Laboratoire de recherches sur les Maladies infectieuses des animaux. — *Journal Officiel*, Forty-fourth Year, No. 283, pp. 8870. Paris, October 17, 1912.

The French budget of April 20, 1901, set apart 100 000 fr. for the construction and maintenance of a laboratory for researches on foot-and-

mouth disease, and the decree of October 31, 1901, arranged the organization and scope of work. The Decree of September 19, 1912, published in the *Journal Officiel* of October 17, 1912, reorganized its functions in the following manner:

The Research Laboratory is attached to the Sanitary Veterinary Service; its work is extended to the studies necessary for the prevention of diseases of animals. It includes two services: 1) the service of control, to which are entrusted diagnoses and the examination and testing of the proposed remedies; 2) the research service, which will undertake such researches as are considered urgent respecting animal diseases. A scientific advisory body settles the order of the researches to be prosecuted and will superintend their execution. The members of this advisory body are nominated by the Minister of Agriculture; they may take part in the laboratory work and receive special grants for this purpose.

1596 - The Decree of August 31, 1912, for the Regulation in Algeria of the Export and Slaughter of Ewes.

Décret du 31 août 1912 réglementant en Algérie l'exportation et l'abatage des animaux femelles d'espèce ovine. — *Ministère de l'Agriculture, Bulletin mensuel de l'Office de Renseignements agricoles*, Year XI, No. 9, p. 1169. Paris, September 1912.

Art. 1. — The exportation of ewes from the territory of Algeria and the slaughter of the same within the said territory are forbidden every year from the 1st of July to the 31st of December.

Art. 2. — As an exceptional measure, this prohibition will be in force throughout the whole of the year 1913.

Art. 3. — The exportation from Algerian territory of lambs of either sex under 20 months of age is absolutely forbidden.

Art. 4. — Sheep of more than 5 years of age may be slaughtered at any time.

Penalties are incurred by the infringement of the provisions of this decree. The decrees of July 12, 1904, Aug. 1 1906, and Jan. 23, 1911. are abrogated.

The above decree was published in the *Journal officiel* of Spt. 4, 1912.

1597 - Measures for the Encouragement of Sericulture in Italy.

Provvedimenti in favore della sericultura in Italia. — *Bollettino del Ministero di Agricoltura, Industria e Commercio*, Year X, Vol. II, Series A, Part 12, pp. 346-348. Rome, September 21, 1912.

In conformity with the law of July 16, 1912, No. 869, published in the *Gazzetta Ufficiale* of August 21, 1912, a Council for the silk interests has been instituted at the Ministry of Agriculture, Industry and Commerce. This council is composed of representatives of agricultural and industrial silk associations, of manufacturers and of the chiefs of the agricultural and industrial services.

In the budget of 1912-1913, 100 000 lire (about £4 000) will be allotted, and in the succeeding years, 500 000 lire (about £20 000), for the object of promoting:

1. The progress of mulberry growing and silkworm rearing.

2. The improvement of existing breeds of silkworms and the creation of new ones.

3. Studies, researches and experimental stations devoted to the progress of the silk industry.

4. The institution of general warehouses for silk produce.

5. and 6. The association of producers for the suffocation of chrysalides and for the sale of cocoons and silk.

Beginning with the year 1912-1913, 100 000 lire (about £4 000) will be devoted to the institution and working of an intelligence and national and international statistics service which will deal with the conditions of production and of the silk market. A further sum of 250 000 lire (about £10 000), available the same year, will enable the Ministry of Agriculture, Industry and Commerce to provide for:

1. The establishement of new Government mulberry nurseries and the enlargement of existing ones, as well as the distribution of mulberries from the above nurseries to farmers.

2. The distribution of prizes to agricultural associations and to private persons who have most contributed to the control of *Diaspis pentagona* and other parasites.

3. The diffusion of such agreements between the hands engaged in silkworm rearing and their employers as to ensure the former an equitable share in the profits, as well as the coordination of all the rules followed in the whole silk trade.

The endowments of the Royal School for the Silk Industry at Como and of the Royal Station for Silkworm Rearing at Padua have been increased; at Ascoli Piceno a station for experimental silkworm rearing and mulbery growing has been instituted; silkworm rearing and experimentation connected with it will be taught in the higher schools of Agriculture at Milan, Perugia and Portici; temporary theoretical and practical courses of silkworm rearing for farmers and workmen will be held, and prizes given; and lastly grants will be allotted to those agricultural travelling lectureships that will assist in spreading a knowledge of the scientific methods of mulberry growing and of silkworm rearing.

1598 - The Food Products of Rhodesia.

DEVELOPMENT OF AGRICULTURE IN DIFFERENT COUNTRIES.

DOUGLAS, LOUDON M. in *The Chemical World*, Vol. I, Nos. 9-10, pp. 309-311; 349-351. London, Sept.-Oct. 1912.

It is probable that Rhodesia may become in the near future one of the important food exporting countries of the world. Rhodesia is a vast

territory covering an area of 750 000 sq. miles, which is larger than Germany, France, Switzerland and Austria all put together. It is to the southern portion of Rhodesia however, that attention is being particularly directed at the present time, and the great plateau which extends between the Zambesi on the north and the Limpopo on the south is being rapidly developed as a food producing area. The extent of this area is 192 000 sq. miles with average altitudes of from 3 000 to 6 000 ft. above the sea-level, and its importance may be recognised when it is considered that the white population numbers 23 606 whereas in the whole of Northern Rhodesia the white population is only 1 497. It is interesting to notice that in Southern Rhodesia, alongside of the white population, there is a population of 771 077 natives. In Northern Rhodesia there are 822 599 natives. These facts are singular, as they show that the settler has located Southern Rhodesia, at least in the meantime, as being the best suited for farming and pastoral pursuits. Coincident with this, it may be recognised that the principal mining industries in Rhodesia so far are those which have been developed in Southern Rhodesia ; the potentialities of the great northern territory being yet comparatively unknown. Systematic agriculture and the growth of food products, is only of comparatively recent origin, with the result that the farms at present have not yet settled down to regular methods of agriculture, owing to the fact, perhaps, that the rich virgin soil has enabled them to produce mealies or Indian corn very easily, and there has been no necessity for studying such questions as the rotation of crops. The Kaffirs in Mashonaland grow a mixed crop of mealies and rapoko (*Eleusine coracana*), which is a kind of Kaffir corn, but their object seems to be to provide against the probable failure of the crop of mealies. This is indeed one of the unfortunate features of the country which has to be reckoned with, namely, the probability of drought and the consequent failure of the maize crop.

The rainfall is not equally distributed throughout the country and is greatest in the higher altitudes, such as in the Melsetter district ; but the most unfortunate part of it is, that the rain comes all in the few months from October to April and then supervenes a considerable spell of dry weather from May to October. These climatic conditions have recently been the subject of considerable study, and it would seem as if insufficient attention has been given in the past to the moisture-retaining soils, which are abundant throughout the country. It would seem to be the correct policy for farmers to carefully select heavy soils, more especially for winter cereals. In this way there is little doubt but that winter cereals such as wheat, oats, and barley, could be grown in great abundance.

A " farm," to begin with, usually consists of from 1 500 to 6 000 acres, and only a small portion of this area is allotted to cultivation, the remainder being devoted to grazing. So far, there has been little call for the use

of artificial fertilisers, owing to the richness of the soil, but this richness is bound to become exhausted in the near future and it will then be a problem how the soil has to be renovated. There is plenty of power in the Victoria Falls to make sufficient nitrate of lime to supply the wants of all the farms in existence in Rhodesia, and a great many more, but the absence of lime itself from the soil, makes it somewhat difficult to grow certain crops. Thus, in the growing of lucerne, it has been found difficult, except in certain areas where lime exists, to grow this plant profitably. On the other hand, such a grass as Paspalum (*Paspalum dilatatum*) has proved to be a valuable winter pasture, more especially on red soils.

The principal food crops grown in the country are: Horse Tooth Maize, French Beans, Speckled Beans, Small Haricot Beans, Kaffir Corn, Munga, Rapoko, Red Beans, White Peas, Wheat, Barley, Native Rice, Manna, Dried Green Peas, Large Haricot Beans, Large Flat White Maize, Yellow Maize, Native Beans, Buckwheat, Velvet Beans, Sunflower, Monkey Nuts, Linseed.

The greatest product of the country is the maize. The other food products vary in quantity very considerably, but they have been all shown to be capable of extensive cultivation, and in the near future it is hoped that a considerable surplus of many of these products will be available for export. In the meantime, the only one amongst them which has been exported to any extent is maize, and it is stated that the recorded figures for maize for 1911 are 393 166 bags, an increase of 758 % in seven years. Of this, 307 635 bags are credited to Mashonaland, and 85 531 bags to Matabeleland. The growth of the export trade in maize is instructive, not for any stupendous figures, but as showing a steady increase, in spite of fluctuating local market conditions, and as demonstrating the commercial value of the facilities arranged for export and disposal in the European market:

Exports of Maize (Mealies) from Rhodesia.

Year	Quantity	Value
	lbs.	£
1907	27 308	95
1908	53 847	246
1909	2 288 453	6 023
1910	5 911 123	11 973
1911	8 272 558	16 878

The principal problem so far has been the supply of local wants, and the feeding of live stock has especially been greatly studied from the point of view of finding a proper ration to suit milking cows, calves, fattening bullocks and fattening pigs. The growing of sheep in Rhodesia is not at

present a serious question, owing to the fact that it has not yet been determined which breed of sheep is most suited to the climate of the country.

The feeding of cattle is becoming a very serious problem in Rhodesia, as it is generally admitted that the future of the agriculture of the country will largely consist of the development of an export meat trade and, with this end in view, dairying and ranching are being largely extended, and it is hoped that within a very short period a sufficient supply of cattle will be available to maintain packing houses on the spot. Under normal conditions, such a state of things should be possible within four or five years, but it will require the united efforts of the farmers to make the scheme a success.

The establishment of bacon curing in Rhodesia has been decided upon as the first of these animal industries which are likely to play such an important part in the future of the country,and it may be said that at the present time there is every chance for this industry being conducted with great profit to agriculture, inasmuch as the imports of pig products into the country and into South Africa generally totals up to something like a value of £400 000 per annum. Such a basis to work upon makes success in this undertaking pretty certain, and there is every chance therefore that by this means large profits may be made to accrue to the agriculture of the country generally.

RURAL HYGIENE

1599 – **Arsenic Compounds in Agriculture.**

AMPOLA, G. and TOMMASI, S. I composti di arsenico in agricoltura. — *Annali della R. Stazione chimico-agraria sperimentale di Roma*, Serie II, Vol. V (1911), pp. 240-377, plates I-II. Roma, 1912.

This monograph is a summary of investigations and experiments on the action of arsenical salts on plants, and on the dangers attendant upon their use in agriculture, carried out in Italy by order of the Ministry of Agriculture in consequence of a resolution of the Superior Council of Public Health of August 14, 1909.

The monograph is divided into chapters:

I. *Historical notice of the use of the salts of arsenic in agriculture.*

It treats of the use of arsenical compounds, dealing especially with the laws and regulations in various countries on the commerce and use of these poisonous products; and reports upon the discussions which have arisen of late years in France owing to the increased employment of arsenical compounds for the control of insects injurious to vines and to fruit trees.

II. *Arsenic compounds and dangers deriving from their use.*

It deals briefly with the various salts of arsenic used in agriculture, with the mode of employing them and with the ill effects they may cause to workmen and to the animals useful to man. Analyses are given of

grasses growing under trees which had been treated with arsenical preparations, and of the leaves of such trees, showing the quantities of arsenic they contained.

Among the soluble compounds the following are considered: arsenious anhydride, sodium arsenite, and sodium arsenate; among the insoluble compounds: lead arsenate, which is recognized as superior to the following: Paris green, London purple, copper arsenite, calcium arsenite and arsenate, ferrous arsenate, lead arsenite, zinc arsenate, barium arsenite and arsenate, and arsenic trisulphide.

From the analyses made it appears that the leaves of olive trees treated with olive-fly mixtures retain a quantity of arsenic equal to about 30 mg. of metallic arsenic or 38.5 mg. of arsenious anhydride per kilogram of air-dried leaves, a quantity which might render them a dangerous feed for animals, especially if they were not previously washed.

III. *Arsenic residues in food-stuffs produced by plants treated with arsenical compounds.* This is a complete review of the investigations made upon the quantities of arsenic which may be found in fruit, vegetables, wine and oil, as well as upon the experimental researches upon olives and olive oils coming from trees which had been treated with arsenic mixtures for the control of the olive-fly. The authors come to the following conclusions: In ripe fruit arsenic is generally found, in quantities ranging from 0.2 mg. to 1.3 mg. per kilogram. In grapes from 1.12 to 4 mg., and in wine from traces up to 1.5 mg. per litre (1½ per million). In olives the quantity varies between 0.12 and 4 mg. per kilogram; in olive oil no arsenic has been found.

IV. *Physiological action of arsenic upon plants.* — Injurious effect of arsenic in the soil upon the growth of plants. Complete review of existing researches on the question, dealing with:

a) Lower chlorophyll-free plants (yeasts, bacteria, fungi).

b) Lower chlorophyll plants (algae).

c) Phanerogams (influence upon germination and vegetation; absorption of arsenic by plants).

Next follows the part in which the authors give the results of experiments made in water cultures and in soil with herbaceous plants (haricot beans, maize, lupins, beans, wheat, rye, barley, lentils) and with woody plants (olive and oleander), furnishing data on the growth of plants to which arsenical solutions had been given, and on the arsenic contained in the various organs of the same plants.

Summing up the phenomena observed in phanerogans which had been poisoned by arsenic supplied to the roots, it appears that in relatively high doses the compound acts immediately on the protoplasm of the root cells, whilst in very weak doses the first effect appears to be on the leaf cells; anyhow the effects become more marked with the increase of trans-

piration. As to the limits of toxicity of arsenious acid, it appears from the experiments of the authors that in nutritive solutions 1 mg. per litre (1 per million) exerts an unfavourable action on the development of phanerogams, 20 mg. being enough, in some plants, to prevent growth completely; the resistance varies with the species of plants. In general, the experiments conducted with several soils show that 0.3 mg. of arsenious anhydride per kilogram of soil is sufficient to reduce considerably the growth of herbaceous plants. Among the various organs in which arsenic may be found, the green organs and especially the leaves are the ones which contain the poison in the greatest quantity, except in cases of immediate poisoning, when the toxic agent predominates in the roots. Lastly the data on the action of arsenic on protoplasm are uncertain.

V. *Arsenic in the soil.* — From researches on the quantities of arsenical compounds which may be introduced into the cultivable soil by the employment of the arsenical compounds used in agriculture, from investigations on the power of the soil of absorbing arsenious and arsenic acid, as well as from the analyses of soils under trees treated with arsenical compounds the authors come to the following conclusions:

a) The excessive and continued use of arsenical insecticides can introduce into the soil a considerable quantity of arsenic.

b) Arsenic can be retained by the cultivable soil and it can accumulate in such quantities as to injure vegetation seriously; drainage water, it appears, does not carry off arsenic to any considerable extent.

c) Whilst arsenic is mostly introduced into the soil under the form of arsenates and of insoluble compounds, experiments have shown that the cultivable soil may contain micro-organisms capable of reducing arsenates to arsenites, and that the alkaline salts of the soil render the insoluble arsenic compounds soluble.

General conclusions. — Whilst, according to the authors, on the one hand the salts of arsenic render undoubted services to agriculture, so much so that thousands of tons are thus consumed, on the other hand the harm and dangers attendant upon their use are such as to justify fully the apprehensions regarding them which are entertained in all the countries where they are employed.

The disadvantages are:

I. Crimes can be committed when, owing to their use in agriculture, arsenical compounds may be freely purchased.

II. Cases of poisoning are liable to happen through the carelessness of the dealers in arsenical preparations when these are sold on premises where foodstuffs are also sold.

III. The salts of arsenic may cause serious cases of poisoning through the ignorance of the country people handling them as to the danger of breathing the poisonous dust and as to the necessity of washing their

faces and hands, and especially their finger nails, after having used these compounds. Frequent cases of poisoning have almost always followed treatments on a large scale.

IV. Not inconsiderable quantities of arsenical compounds may adhere to workmen's boots and thus be introduced into their houses and into warehouses, in which, owing to the want of cleanliness and to dampness, arsenical moulds may develop, giving rise to the formation of exceedingly toxic vapours which can easily cause poisoning, as has happened with paperhangings coloured with the same compounds which are used as insecticides (Paris green and Schele's green). Poisonous gases are easily evolved by the moulds on agricultural products containing even very minute quantities of arsenic.

V. Arsenical sprayings can also destroy bees and other useful insects, especially when the treatments are carried out during the blossoming of trees and when saccharine substances are used for the mixtures. Honey may become poisonous. In operations directed against locusts and voles there is always the danger of poisoning poultry and game.

VI. In fruit coming from trees treated with arsenical compounds arsenic is always found, generally in minimal doses, but which sometimes attain 2 mg. and upwards per kilogram of fruit and 1.5 mg. per litre of wine. These quantities are above the limits allowed by the British Royal Commission on arsenical poisoning.

These quantities of poison are not of much importance taken singly, but they would no longer be negligible if the use of arsenical compounds were to extend and to become general for all crops. In this case the poison would be found almost everywhere and the minimal doses present in the various daily foods would accumulate in the organism and might produce chronic poisoning which would not be noticed, as was the case in England with beer containing arsenic.

VII. During tree-spraying some poison falls on the grasses on the ground and it may prove injurious to the domestic animals feeding on them. Rabbits and those birds which, as well as snails, resist the action of arsenic, may become vehicles of poisoning for man.

VIII. Though the quantities of arsenic which fall to the ground cannot cause immediate mischief, yet in the long run if the use of such compounds were extended to all crops they might become considerable, and if they would not actually prevent the growth of herbaceous and woody plants, they would certainly injure it. In woody plants, if any wound or root-rot occurs, the toxic compound easily penetrates into the interior of the plant. To this is very probably due the death of thousands of trees in Colorado and Utah, where the sudden changes of temperature and the alkalinity of the soil caused rot in the crown or in the roots of the trees, which afforded arsenic an easy entry into the interior of the trees.

IX. Poisoning can easily happen from eating vegetable food grown on soil containing arsenic. Headden found arsenic in the urine of people who had eaten the fruit of trees grown on land on which arsenical insecticides had been used for years.

1600 - On the Duration of Vitality and the Development Capacity of Cholera Vibrios on Fruit and Vegetables.

POLLAK, DR. FELIX. Ueber die Lebensdauer und Entwickelungsfähigkeit von Cholera-vibrionen auf Obst und Gemüse. — *Centralblatt für Bakteriologie, Parasitenkunde und Infektionskrankheiten*, First Part, Original Articles, Vol. 66, Part 7, pp. 491-495. Jena, October 1912.

It is known that the necessary condition for cholera infection in the case of man is the ingestion of Koch's vibrio. From some observations made in 1911 in the Adriatic portion of the Austrian Empire, on the occasion of the last outbreak of cholera, the attention of the writer was drawn to the part played by infected articles of food in spreading the disease. As the data on this subject were very scanty, he studied several kinds of fruits and vegetables in order to find out how long the cholera vibrios present on them remain alive and capable of development.

According to Uffelmann (quoted by Getschlich, in Kolle-Wassermann's *Handbuch der Pathogenen Mikroorganismen*) cholera vibrios on cauliflowers remain alive for from 1 to 3 days. According to Friedrich and Lawrinowitsch (quoted in the same work) the vibrios die sooner, as a rule, on the pulp of fruit; but they live for some days, nevertheless, on cherries, pears and water-melons, and even melons seem to be a good nutritive substratum. It appears that the vibrios can remain alive for some days on the surface of fruits, unless they are affected by desiccation, light, or also, probably, by moulds. According to Dobrosklousky (*Centralblatt f. Bakt., etc.*, Abt. I. Referate, Bd. 48, Heft 22), cholera vibrios disappear in 24 hours if they are placed inside a grape; while they live 4 days on the skin, and 14 days on the stalk of the bunch.

The researches of the writer were made on citrus fruits, apples, spinach, cabbage lettuce, chicory, etc. The material was infected by immersion in a physiological solution of sodium chloridc into which had been placed a 24-hour culture of cholera vibrios on agar. The examination began 24 hours after the infection and was continued regularly every day. To this end, the infected material was put into peptonised water and kept for from 6 to 22 hours at 37° C; then cultures were made by streak inoculation. Other methods were adopted which gave identical results. The researches were prosecuted for three months, from February to April, and the detailed results are entered on a table.

The examination of the results shows that diffused daylight does not affect the vitality of the vibrios; damp is the factor which is most fa-

vourable to them, and all meteorological factors have influence according as they increase or decrease the humidity. The different behaviour of the vibrios on the fruits and vegetables mentioned is due in some degree to their different moisture retaining properties. The multiplication of the vibrios is hindered, not only by diminution of humidity, but also by the competition of moulds, ferments and schizomycetes. The vitality of the vibrios diminished on oranges after 2 or 3 days; on lemons they were still alive after 8 or 14 days; they lived 15 days on apples, 29 days in the heart of lettuces and for a shorter time on other green vegetables, in fact as long as the latter remained fresh.

In conclusion the writer states that peeling fruits and cooking vegetables does not suffice to remove the danger of direct infection, since the pathogenetic agent brings an indirect danger of infection into the house (manipulation, water used for washing, flies, etc.).

Raw salad must remain at least $^3/_4$ hour in vinegar before the cholera vibrios which it may contain are incapable of propagation. The writer also advises, in the event of an outbreak of cholera in a district, that it should be fobidden to export fruits and vegetables from such a district to others that are immune.

1601 – Researches on the Toxicity of Fungi.

PARISOT, J. and VERNIER. Recherches sur la toxicité des Champignons. Leur pouvoir hémolytique. — *Comptes Rendus hebdomadaires des Séances de l'Académie des Sciences*, Vol. 155, No. 14, pp. 620-623. Paris, September 30, 1912.

The writers have made researches on the blood-destroying properties possessed by the extracts of poisonous fungi (haemolytic properties). They experimented with edible and with poisonous fungi belonging to the principal families and especially to the *Agaricinae*, *Polyporcae*, *Hydnaceae*, *Clavarieae*, *Pezizaceae*. Freshly picked fungi were pounded up and put to macerate in a volume of 0.9 per cent. sodium chloride solution equal to half their weight. After half an hour, the whole of the liquid portion was collected by pressing and the sodium chloride was again made up to 0.9 per cent. With this extract, the experiments on the haemolytic property *in vitro* and *in vivo* were carried out, using the same methods as are employed for demonstrating the presence of organic and bacterian haemolysins.

Speaking generally, it may be stated that the haemolytic property of fungi, when it exists, is very intense *in vitro* and is also considerable *in vivo*. Thus, the intravenous injection of less than ten drops of extract of *Amanita phalloides* Fr. kills an adult rabbit in a few seconds. It is certain that this fungus possesses the largest amount of haemolytic power, but other poisonous fungi have a strong similar action, though it is less

marked. Only *Entoloma lividum* Fr. seemed to the writers to be free from this property.

It is important to notice that many edible fungi also have this destructive action on blood, not only *Amanita rubescens* Pers., but also *Hydnum repandum* L., *Tricholomia nudum* Fr., *Laccaria laccata* Be. and Br., *Craterellus cornucopoides* Fr., etc. In some cases, where the fungi have no haemolytic power when *young* and *fresh*, they acquire it when old. These facts agree with the observations of the writers, who found that fungus extracts which were non-poisonous when fresh, developed toxic properties when left for 12 hours.

The haemolytic property of fungi is usually lessened by heating; boiling for five minutes over an open fire seems sufficient to render the liquid extracts innocuous, but in certain cases their precipitate retains some amount of haemolytic power. These phenomena appear to be attributable to the more or less complete chemical transformations of a glucoside, to which, according to the writers, the toxic properties of the fungi are due.

Certain substances, especially the cholesterine present in milk and in the yolks of eggs, etc., have the power of decreasing and hindering in a remarkable degree the haemolytic properties of fungi, while on the other hand, animal charcoal, even after a contact of several hours, has no effect.

When a heated extract is no longer haemolytic, it loses a great part of, or all, its poisonous property *in vivo*, but when the whole fungi are cooked according to ordinary methods they often retain a certain haemolytic power, so that they should be cooked for a long time, and at a sufficiently high temperature (the addition of oil is to be recommended) in order to bring about the complete hydrolysis of the haemolytic glucoside.

AGRICULTURAL SHOWS AND CONGRESSES

1602 - **Agricultural Shows in Paris in 1913. — I. General Show for Fat Stock and Agricultural Products from January 27 to February 3. — II. General Show for Breeding-Animals in June.**

Concours général d'animaux gras et de produits agricoles du 27 janvier au 3 février. — Concours général d'animaux reproducteurs en juin. — *Journal Officiel de la République Française*, Year XLIV, No. 293, p. 9132. Paris, October 27, 1912.

By decree of the 25th of October, 1912, the Minister of Agriculture of France has established that a general show for fat stock and for agricultural products is to be held in Paris in 1913 from the 27th of January to the 3rd of February. The competition will include:

1. Fat stock (cattle, sheep and pigs).
2. Fat poultry.
3. Live poultry and rabbits (for breeding).
4. Dairy produce (butter and cheese).
5. Agricultural and horticultural products.

6. Wine, cider, perry and brandy.
7. Work relating to agricultural mutuality.
8. An exhibition of materials for packing and poultry.

There will be an exhibition of agricultural implements and machinery at the same time as the show; it will be held on the Esplanade des Invalides from the 27th of January to the 5th of February.

The programmes of the shows can be obtained by those interested, from the Ministry of Agriculture, 78 Rue de Varennes, Paris, and at the prefectures from the 20th of November 1912.

The general show for breeding cattle, sheep, pigs and sheep-dogs will be held in Paris in June. During April, a notice will be published giving the date and regulations of the said show and the place at which it will be held.

1603 - **Show of Thorough-Bred Stallions, at the Royal Agricultural Hall, Islington, London, on March 11th-13th, 1913.**

Regulations for the Show of Thorough-Bred Stallions suitable for getting Half-Bred Horses, to be held at the Royal Agricultural Hall, Islington, in conjunction with the Hunters' Improvement and National Light-Horse breeding Society, on March the 11th, 12th and 13th, 1913. — *Board of Agriculture and Fisheries*, 11 pp.. London, 1912.

A show of thorough-bred stallions suitable for getting half-bred horses will be held at the Royal Agricultural Hall, Islington, in conjunction with the Hunters' Improvement and National Light Horse Breeding Society, on March the 11th, 12th and 13th, 1913.

The premiums offered are the following:

A King's Champion Challenge Cup, that will be held by the winner for one year only, and shall then be returned to the Board of Agriculture and Fisheries; a Gold Medal, offered by the Board of Agriculture and Fisheries for the owner of the Champion Stallion; forty-four King's Premiums, of the average value of £197 12*s.* 6*d.* each, offered by the Board of Agriculture and Fisheries for award to thorough-bred stallions, not under four or over twenty years old, to travel prescribed districts in England and Wales, fees being paid by the Board in respect of (but not exceeding) 90 mares, and the earnings of a Stallion serving that number being approximately £410; not more than 10 Super-Premiums of the value of 100 guineas, to be awarded, in addition to the ordinary premium, to selected stallions of exceptional merit.

Entry forms may be obtained from the Secretary, Board of Agriculture and Fisheries, 4, Whitehall Place, London S. W., on or before January 27th, 1913 or on or before February 3rd, 1913 for post entries.

The following are some of the conditions of entry and exhibition and regulations for the location and service of King's Premium stallions.

Every stallion must be registered under the Board's registration scheme before it can be accepted for entry at the Show, and must not be under

4 or over 20 years old. Application for the registration of stallions to be entered for the Show should be made not later than 1st January 1913.

The Board reserve the right in respect of any stallion which has won four Queen's or King's premiums in any district class as arranged by the Royal Commission on Horse Breeding or by the Board of Agriculture and Fisheries in connection with Shows held under their auspices, to refuse absolutely or conditionally an entry of such stallion in the district class as now arranged by the Board of Agriculture and Fisheries which comprises the locality in which such stallion stood or travelled for service in respect of the premiums previously awarded.

The Board reserve the right to refuse the entry of a stallion which has been awarded premiums by the Royal Commission on Horse Breeding or the Board of Agriculture and Fisheries, and whose percentage of foals taken on the average over two consecutive seasons of service as a premium-winning stallion does not exceed 40 per cent. Where a stallion has been in training, and has run on the flat or across country, a record of its performances must be given on the entry form, and also the length of time the horse was in training.

Every stallion to which a King's premium has been awarded shall travel, as the Board may direct from time to time, in the District for which it is awarded a premium, and shall serve any mare for the service of which a free nomination ticket has been issued, and any mare which has been purchased and leased by a County Committee to a farmer or other person as to the service of which notice has been received on or before the 31st May, and also any other mare presented for service, provided that the total number of mares so required to be served shall not exceed seventy.

The stallion shall travel at a service fee not exceeding 40s. for each mare and a groom's fee of 2*s.* 6*d.*, both fees payable in advance. If a mare, subsequent to the payment of a service fee, becomes unfit for service, any fee so received shall be refunded. If the owner of the mare presents a free nomination ticket, no fee other than the groom's fee may be charged to him. The free nomination fee of 40*s* will become payable to the stallion owner by the Board at the close of the service season. A record of the services of mares is to be correctly entered in the Service book provided for the purpose by the Board.

1604- IX International Congress of Applied Chemistry at St. Petersburg in 1915.

La Sucrerie indigène et coloniale, Vol. LXXX, Year 48, No. 15, p. 350. Paris, October 9, 1912.

At the eighth Congress of applied chemistry held in New York between the 4th and 13th of last September it was decided that the Ninth Congress should be held at St. Petersburg in 1915.

CROPS AND CULTIVATION

1605 - **The International Organization of Agricultural Meteorology.** AGRICULTURAL METEOROLOGY.

R. D. L'Organisation internationale de la Météorologie agricole. — *Revue Scientifique*, Year 50, No. 15. Paris, October 12, 1912.

In May 1911, at the General Meeting of the Delegates of the 48 States adhering (1) to the International Institute of Agriculture, the conclusions of M. Louis-Dop, delegate of France, and Vice-president of the Institute, were adopted, and it was decided that his report should be officially forwarded to the President of the International meteorological Committee.

As a result of the meeting of the Commissions of Meteorological telegraphy and weather signals, held in London from the 17th to the 24th of last September, the President of the Committee, Mr. Shaw, decided to convene in Paris a Commission of five members, with the object of making the first draft of a scheme for the organisation of agricultural meteorology on the same lines in the different countries. This Commission consisted of: M. Angot, Director of the Central Meteorological Bureau of France, member of the International Meteorological Committee; Prof. Börnstein, of the Higher Agricultural School in Berlin; M. Brounoff, Emeritus Professor at the Imperial University of St. Petersburg, and Chief of the Meteorological Bureau of the Scientific Committee of the Ministry of Agriculture; Prof. Palazzo, Director of the Meteorological Service of the Kingdom of Italy; and M. Louis-Dop.

This Commission, which sat for three whole days (26th to 29th Sept. last) at the Central Meteorological Bureau of Paris, recognized unanimously the interest and importance of the problem of agricultural meteorology and drew up a certain number of resolutions, which will be submitted for the approval of the International Meteorological Committee.

1) The institution of a Permanent Committee of Agricultural Meteorology on the same basis as that on which the International Scientific Committee for the Study of the Atmosphere was established. This project includes a series of international measures, which will tend to promote the practical application of general meteorology.

2) The devising and the construction of different instruments, simple enough to be generally used, for measuring the duration of sunshine and the intensity of solar radiation, and for observations on dew, fog, etc.

3) The comparative study of the different methods of placing thermometers for the observation of temperature at different heights, between the plants themselves and above them.

(1) At present, the number of States adhering to the Institute is 50. (*Ed.*).

4) The systematic observation of the phenomena of atmospheric optics: haloes, coronæ, the colours of the sky, the colours and length of twilight, abnormal refraction, mirages etc., all of which are of great importance for local weather-forecasting.

The progress which would result from the carrying out of these various resolutions would be lessened if the data obtained could not be widely published and made known. The question of the publication and dissemination of this information therefore occupied a large amount of the attention of the Commission.

The Commission considered that monthly meteorological bulletins deal with too long a period of time to be of use in comparative agricultural studies. The Commission thus recommended the publication of bulletins every ten days, and that they should appear as soon as possible and contain, at least, observations on temperature, rainfall and the height of rivers. It would be useful to add information as to the level of subterranean water-tables. The publication of these bulletins, however, would not involve the suppression of the monthly bulletins, which ought to be continued.

The Commission finally recommended a measure of great importance to agriculture, *viz.* the regular publication of statistics showing the distribution in time and space of certain meteorological phenomena of special importance: temperature, frosts, rainfall, storms, hail, etc., and the relation which these bear to the vegetation covering the soil and to the orographic and hydrographic conditions. It would be advisable that the public should be able to obtain this information at a moderate price.

With the desire of circulating among the public and the agricultural world the data which have already been obtained, and of supplementing those already published by the meteorological bureau, the Commission recommends:

1) That in each country a certain number of district centres should be established (following the example of the United States and Germany), which, on the receipt from the Central Bureau of a sufficient number of telegrams, should draw up on the spot charts representing the general atmospheric conditions, and should forecast the local weather conditions.

2) That these district centres, though autonomous as regards local weather reports, should be placed under the scientific direction of the Central Service, as by this means alone can unity of ideas and agreement be maintained among the different centres.

Finally, the Commission put the following resolutions to the vote:

1) That the daily weather charts drawn up in the district centres, should be offered to the public at a price as low as possible.

2) That these charts should be supplied to the elementary schools and that the teachers should be familiar with their use.

This work would be incomplete if the rural population did not quickly receive information of the observations collected; the Commission therefore recommends that rapid methods of disseminating weather forecasts throughout the country should be devised, by studying the attempts hitherto made in this direction in different countries, notably in the United States.

Such is the important work which has been done, in the course of a few sittings, by the Commission nominated by the International Meteorological Committee. It deals with practically all the means which will allow of the speedy solution of the important problem of agricultural meteorology.

It will fall to the share of a fresh mixed Commission, which will meet in Rome next spring, to carry out a reform, of which the beneficial effects and practical results will quickly force themselves on the attention of all the Governments.

1606 – "Edaphism": a New Theory on the Relation between Plants and the Soil. Its Applications to Agriculture.

SOIL PHYSICS, CHEMISTRY AND MICROBIOLOGY.

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BASES.

The study of the soil, which was formerly almost exclusively chemical, has lately extended to the biological and physical conditions which sometimes are of paramount importance in the economy of the fertility of the soil. And it is especially for physico-chemical considerations in connection with the physiology of plants that recently such special importance has come to be attached to the so-called soil solution, namely the moisture contained in the soil, which forms the natural medium that supplies plants with the elements indispensable for their development.

Schloesing and, to a great extent, the Soil Bureau of the Department of Agriculture of the United States, have laid down the main lines of this new trend, to which methodical and critical contributions have been made by König, Grégoire, Hall and others. But whilst American investigators have rather dealt with the chemical qualitative and quantitative analysis of the water extracts of the soil, and König and his collaborators have especially considered the physico-chemical determination of the soluble substances existing in the soil, in a recent series of investigations on "edaphism", G. Gola, of the Botanical Institute of the University of Turin, examines the liquids really existing in the soil as being those which are in most direct relation with the absorbent system of plants; taking also into account the chemistry of the colloids, the importance of which was recognized by van Bemmelen and his school and recently confirmed by Ramann among others.

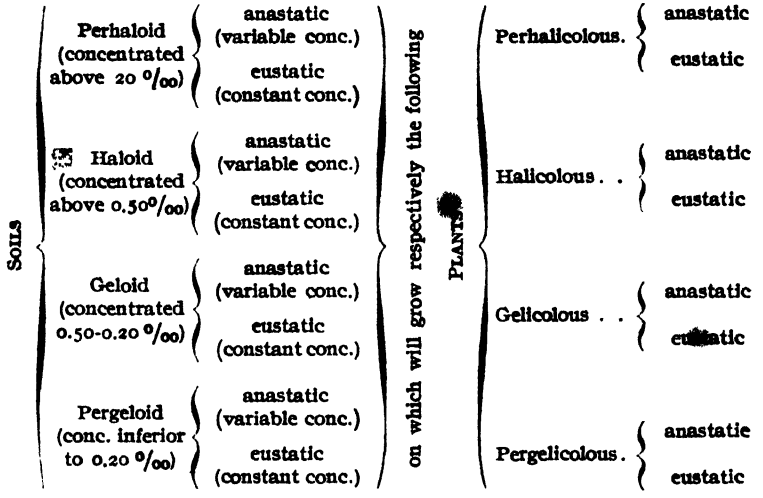
By "edaphism" is meant the totality of trophic and geographical relations, that is of nutrition and surroundings, between the plants and the soil; consequently the fundamental problem of edaphism is the study of the liquids of the soil and of the physical, chemical and climatic factors which may modify their properties.

TECHNIQUE.

The technique adopted by the writer in his researches consists in utilizing the action of rain-water upon the soil, submitting the soils experimented upon to an artificial rain; studying the liquids obtained by simple

leaching out and by means of strong pressure. He calls "pedolysis" the washing out of the soil by rain, "pedolitic" liquid that obtained by simple washing out, and "pedopiezic" the liquid obtained by pressing the treated soil. These two liquids appear to represent, more closely than those obtained by any other method, the result of the action of rain upon the soil.

On the basis of such determinations, and according to the degree of concentration of the liquids thus obtained — high or low, constant or variable during the same season — the writer proposes the following classification of the characteristic pedological types:



Observations

The principal results of the investigations made on about 800 samples of various soils may be summed up as follows:

1. *The process* of "*pedolysis*" determines the removal of a large proportion of the soluble substances in the soil, while the colloid compounds in the state of "hydrosol" and "hydrogel" remain in greater quantities in the "pedopiezic" liquid; that is, the rain rapidly empoverishes the soil of those substances existing in the superficial layers either in a state of solution or easily soluble. Naturally, light rains which do not penetrate to any great depth cause, in the superficial layers, the formation of solutions possessing a higher degree of concentration than in the "pedolitic" liquid. The concentration of the soil liquids varies also with the chemical and mineralogical composition of the soil itself; reaching a maximum in salt soils and progressively decreasing in lime, magnesium, sedi-

mentary clay and red clay (" ferretto ", " red soils ", " laterites ") soils as well as in humic heath-soils.

2. *The mineralogical composition* of the soil has an influence on the degree of concentration, either by determining the formation of soluble matter or of hydrated very unstable compounds — colloids, zeolitoids — which by absorption or double decompositions are capable of fixing certain soluble substances to a greater extent than others. Thus sodium chloride, sodium nitrate, calcium bicarbonate are among the bodies least susceptible of being absorbed ; silicious soils not free from alkali may give rise to hydrated products possessing an intense power of absorption for certain salts ; and the same may be said of some humic compounds. Hence the name of " geloid " for the soils capable of yielding absorption products and of " haloid " for those in which the character of salinity prevails ; " pergeloid " and " perhaloid " are respectively those in which the above characters attain their maximum. Nevertheless the low concentration of the liquids is not always caused by the presence of large quantities of bodies possessing a high absorbent power (gels), but also by the absence of soluble materials, as in many silicious, sandy and very porous soils, or as in some red clays (argille di ferrettizzazione) almost free from alkalis ; but whichever be the cause, the result is the same, namely that the low concentration is identical with that of the " geloid " soils.

3. The *drying up of the soil* even at ordinary temperatures causes a very considerable increase in the amount of soluble substances before the advent of rain ; a light rain in such a case produces a highly concentrated medium around the roots of plants, whilst continued rain causes a much greater impoverishment of the soil than if the soil were to keep fresh and slightly moist. The influence of drought on the increase of soluble substances is least in soils very rich in neutral salts (sodium chloride, magnesium sulphate), and much greater in those containing alkaline substances in a state of complex combinations. The increase of salinity of the dried soil is due in the first place to the dehydration of many compounds of the soil itself, and also to the ascent by capillarity of the saline solutions existing in the lower layers of the soil and which concentrate at the surface, causing the formation of crusts and even of efflorescences. This is important because it allows the return to the surface of substances which had been dragged by the rain down to the deep layers of the soil. In this mobility of the substances contained in the liquids of the soil, the most important part is played by crystalloids, the least by colloids. Lastly, the superficial drying and consequent ascent by capillarity of saline solutions is much more marked in averagely porous soils, and its effects being more felt in regions subject to long alternating periods of drought and of rain, it may cause very great oscillations in the concentration of the liquids surrounding the roots.

4. *Rain* causes the saline solutions to sink again into the soil, but the depth which they reach is limited by the amount of rainfall and by the water capacity of the soil ; consequently either rich solutions remain round the roots in soils having a high water capacity and during short periods of rain, or a real leaching out of the soil takes place in very porous soils and during the seasons of heavy rains.

5. *The concentration of the solution of a soil* does not therefore remain constant throughout the depth traversed by the roots of plants, but undergoes continuous changes according as one or the other factor prevails : dry·ng up of the soil, more or less prolonged rains, etc. Of course the suppression of some of these factors may cause a relative constancy in the concentration of the liquids in the soil. Thus with the permanence of a certain freshness in the soil, such as is met with in moist cold temperate climates and in western aspects, that brusque increase in salinity which follows the dehydration of some of the compounds of the soil never takes place. Thus also a soil exposed to long periods of rain is completely leached out and the concentration of the liquid cannot but be low. The same is the case in soils subject to a variable climate, but possessing a texture either so coarse or so fine as to obviate to a considerable extent the ascent by capillarity of the deep-lying liquids, when in such soils, on account of their chemical composition, a weak initial concentration is naturally formed.

6. *Other exterior causes* may act as moderators of the factors of oscillation : such as, for instance, the presence of dense vegetation which protects the soil against excessive changes of temperature, ventilation and evaporation ; thus a prolonged or permanent drought may hinder the activity of nitrifying bacteria capable in their turn of considerably increasing the solubility of the alkaline earths ; thus also prolonged drought and the excessive rigor of the climate paralyse the activity of the fungi which convert plant remains into humus ; the result is the formation of an acid humus, characteristic of moors, gifted with a very high absorbent power and capable of lowering in a marked degree the concentration of the solution in the soil.

7. *The absorbent properties of the soil* are also factors influencing the solutions in the soil. Thus besides the above mentioned absorbent power of acid humus, there are the absorbent properties of the colloid and zeolitoid bodies of cultivated soils ; but these properties are connected either with the conditions of hydration of the soil, or with the absence of great meteorological changes which may cause substitutions of one ion for another in absorption compounds in an order differing from the normal decreasing succession :

Ammonium, potassium, magnesium, calcium, nitric, sodium and chlorine. These changes and substitutions of ions are much more frequent

when the static conditions of the soil particles are modified, as by tilling operations. On the contrary in soil that has remained intact for a long time the particles of " gels " which have not been rendered mobile by water or only to a slight degree and have filled up the pores of the soil, moderate the intensity of the reactions which may take place among the several mineral particles. Another cause that can render the concentration of the soil liquids fairly constant is the presence of soluble substances in such quantities as to saturate the water circulating in the soil.

8. *The constancy of concentration* is further favoured by all those causes which protect the soil from all more or less brusque variations of its physical conditions ; as for instance in soils covered by dense vegetation, woods, meadows, pastures, etc., in temperate climates, while in bare soils, shores, alluvial deposits, landslips, ploughed fields etc. the concentration undergoes remarkable and rapid changes especially when diminishing.

9. " *Eustatism* " *and* " *anastatism* " that is, the states of constant and variable concentration of the soil solution, are properties of great importance, not only as regards the permanence of certain substances in the soil, but also for the function of absorption by the roots of plants. All the causes that determine " anastatism " of the soil act with intensity only to a relatively slight depth ; at the depth to which the roots of trees penetrate, the degree of concentration keeps much more constant.

Applications.

As practical conclusion, two important series of deductions may be made from the foregoing results.

a. *From the methodological point of view.* The study of the chemistry and physics of the liquids in the soil and of their soluble substances must be conducted on fresh and not dry samples, because between moist and dry conditions there are differences similar to those between living and dead organisms.

b. *From the point of view of agricultural or forest applications.* The various types of soil differ very much from each other in respect of the liquids with which they are imbibed. Bare and ploughed lands, vineyards, etc., are especially " anastatic " whilst soils under woods, meadows and pastures are " eustatic ". The first, through their marked " anastatism " and the manures given them, are always " haloid " or " perhaloid " ; the latter are sometimes " haloid " and sometimes " geloid ", especially if on silicious soil or on a calcareous one the surface of which has been decalcified ; sometimes they are " pergeloid " as in many poor alpine pastures, moor meadows and heaths.

But on the same area the soils available to plant life may be of different character and situated one above the other ; thus, for instance, in a forest

the trees may drive their roots down into a marl or other calcareous and "haloid" soil, while the grasses keep theirs in the weathered superficial layers which are decalcified and "geloid". Similarly in a wheat field, at the beginning of spring the thinly covered soil is evidently exposed to conditions of "anastatism", while in May when the crop is fully grown, and the surface is more protected, conditions of "eustatism" last longer and then disappear at harvest time.

All the practices of intensive cultivation tend to render the soil as "anastatic" as possible, not only in fields and in vineyards, but also in those cases in which the crops continuously clothe the land. Breaking up the turf of old measows and pastures results in the destruction of the superficial humus and setting up new chemical reactions between the soil particles and consequently a state of "anastatism". The declining of forests often coincides with the increase of demineralization of the surface of the soil which allows of some "gelicolous" species such as, *Sphagnum*, other mosses, *Callnna*, to form a felt-like covering to the soil and to hinder the life of those underground organisms that continually renew the soil. The liming of old heaths, and the application of gypsum to clays, give rise in one case to the formation of soluble humates, and in both to the coagulation of colloidal bodies, and consequently to the diminution of the absorbent power to which the marked "eustatism" of such soils is due.

Thus whilst the "anastatism" of the soil solutions appears as the general stimulant of plant metabolism, "eustatism" acts on the other hand as a moderator of this function. This moderating action seems useful to the slow progress of the formation of spontaneous plants, but it is harmful to the rapid and intense life required in cultivated plants.

It is not enough to supply the soil with the elements necessary to plant life, but their absorption by roots must also be provided for.

General Conclusions.

I. The optimum conditions for an active mineral nutrition and consequently rapid development of plants are represented by the continual variations of the degree of concentration of the solutions in the soil.

II. Every effort of the practical farmer must tend to promote in the soil the formation of such concentrations as by their intensity and duration are the most favourable to the economic development of the various species of cultivated plants.

1607 – The Volumetric Representation of the Composition of Soils.

Bièler-Chatelan, Th. Die Zusammensetzung der Ackerböden in volumetrischer Darstellung. — *Internationale Mitteilungen für Bodenkunde*, Vol. II, Part 4, pp. 341-350 + 2 tables + 5 figs. Berlin, 1912.

The usual method of representing by weight the composition of arable soils, being based on accurate weighings, seems at first sight, to be very

exact and capable of furnishing the most satisfactory data for the comparison of soils. It undoubtedly has these advantages in the case of the chemist, who is accustomed to the use of the balance and to the interpretation of gravimetric figures; but the latter are of little use to the agriculturist; they do not show him the soil as he observes it daily in the fields, nor explain sufficiently its nature and properties, and this for several reasons:

1. What is of importance to the plant is not the *weight* of the constituents, but their *volume*, on which depend both the *space* left to the roots for their development and the *surface* of the particles with which they are in contact and whence they obtain their nourishment. Thus, a soil containing 80 per cent. by weight of gravel seems at first sight to consist almost entirely of the latter and to allow of very little space for the roots; but in reality, the stones only occupy 30 per cent. of the volume, and thus leave more room for the roots than would appear from the weight.

2. Estimation by weight, as it neglects, to a greater or less extent, two essential constituents — *water* and *air*, is generally incomplete.

3. Estimations by weight of soils frequently referring to those of apparently unequal density, are not nearly so comparable as they appear, for the weight unit may thus represent *very different cubes of soil*. Thus, while 1 kg. of an essentially mineral soil only occupies $^3/_4$ of a litre, the same quantity of a very humous soil (*e. g.* peat) may occupy up to 2 litres, that is to say two or three times as much. From the cultural point of view, 1 kg. of the first would thus not be at all equivalent to the same amount of the second.

4. The gravimetric figures of physical analysis are sometimes not comparable, because they represent constituents of different density. Thus, while the volumes of the mineral constituents (siliceous sand, lime, clay) do not exceed $^1/_4$ of their weight, humus, which is much lighter, occupies a volume almost equal to its weight, *viz.* about 3 times more than that of the above-mentioned substances. For example, 15 per cent. by weight of humus is not equivalent to 15 per cent. by weight of sand, but occupies the same volume as 30 to 40 per cent. of the latter. The gravimetric figures used in physical analysis are not all of them proportionate to the part played by each of the constituents and thus do not always give an exact measure of their respective importance, all the more since these constituents are distributed in cubes of soil which are sometimes very different and therefore hardly comparable.

For all these reasons, it would be preferable to represent the composition of soils by unit of volume and not by unit of weight. A clearer idea would thus be obtained of their real constitution, and the analyses would better admit of comparison.

What has hitherto deterred agricultural investigators from using this method, has evidently been the fear of not obtaining comparable values, owing to the great variations in volume resulting from the unequal compactness of the soils. It is not a question of the artificial compression of the sifted fine soil, obtained in the laboratory experiments. Such results are too arbitrary and variable and differ too much from the condition of the soil *in situ*, especially as regards the disappearance of the crumb structure (" Krümelstruktur ") proper to soils in good physical condition. The physics of the soil must, as far as is possible, be studied *in situ* in the condition in which it is found in the fields, meadows and woods. But even under these natural conditions, the compactness may vary, as has been shown by Dehérain by the following figures, which refer to 1000 cc. of soil :

	Volume of soil	Volume of water	Volume of air	Volume of spaces (water + air)
	cc.	cc.	cc.	cc.
1. Garden soil.	365	252	383	635
2. Well tilled soil	378	172	450	622
3. Soil not tilled for 3 years . . .	466	168	366	534
4. » not tilled for 6 years . . .	515	152	333	485
5. » ploughed, before rolling . .	378	172	450	622
6. » » after » . .	457	177	366	543
7. » scarified, harrowed and rolled	512	188	300	488

It is seen how much the compactness varies with the working of the soil. Nevertheless, the close agreement between the unworked and the rolled soils (Nos. 3 and 6; 4 and 7) permits us to conclude, that by taking type samples from uncultivated land (meadows) or, in case of need, from well rolled fields, we may feel assured of obtaining sufficient uniformity in the samples as to render analyses comparable.

For sample taking, the writer recommends a steel cylindrical soil-borer of one litre capacity and at least 80 mm. (3.15 in.) diameter, capable of being closed at each end by an adjustable cover. The sample obtained is dispatched to the laboratory in the borer, closed in the above manner, and suffers no change either in weight or volume. At the laboratory, the cylinder and its contents are weighed for the purpose of determining

the weight of the moist soil. On removing the upper lid, the cylinder is at once put into an oven at 110° C. and there left till its weight becomes constant. Its new weight is then that of the dry soil, and the difference represents the weight of the water. The corresponding volumes can then be calculated by dividing the weights found by the respective actual densities (2.65 for an average soil, 1 for water) (1). The volume of the air is given by the following equation:

$$V_a = 1 \text{ litre} - (V_t + V_e),$$

where V_a represents the volume of the air, V_t that of the dry soil and V_e that of the water.

The difference: 1 litre $- V_t$ gives the volume of the spaces, which is also given by the equation:

$$V_p = V_e + V_a.$$

When the volume corresponding to the weight of the soil is known, it is easy to express in volumes ‰ the weight of the constituents given by analysis.

This method permits of a more accurate estimate of the actual water capacity of the soil than can be obtained by the usual means employed in the laboratory, for these often give figures which are far from correct, and are generally too high from the following reasons: 1) sifted and artificially compressed soil is used, which has lost its crumb structure; 2) the soil is made too compact and much more air is expelled than occurs in soils *in situ*.

The measure of the empty space, or the volume of the pores, gives data as to the maximum water capacity of soils and the supply for the springs.

To represent the constitution of very coarse stony soils, it is fundamentally inexact to merely state the composition of the fine particles, as is often done. To express the actual constitution of these soils, especially for agricultural maps, it is necessary to allow for the volume occupied by the stones. As this often exceeds 1 litre (1 cub. decimetre), the experimenter must adopt a larger unit than a litre: 50, 100, 500, or even 1000 litres (0.05, 0.1, 0.5 or 1 cubic metre). It would further be well to take the cubic metre as the unit, when the composition of soils is expressed per hectare.

The following comparisons show the differences between representation by weight and by volume.

(1) For soils of less than average density, the density must be determined in each experiment (*Author's note*).

I. *Water content expressed in weight and in volume.*

		Weight of water °/₀₀	Vol. of water °/₀₀
Loam	(approx dens. = 1 3)	115 6	176
Peaty soil	(approx. dens. = 0.5)	115.6	57.8
	Ratio	1 : 1	3 : 1

II. *Physical composition expressed in weights and in volumes.*

	A. in weights		*B.* in vols.	
	Loam gr. per kg.	Peat soil gr. per kg.	Loam cc. per litre	Peat soil cc. per litre
Water	40	70	52	35
Ratio . . .	*1 : 1.75*		*1.5 : 1*	
Humus	20	750	21	304
Ratio . . .	*1 : 37.5*		*1 : 14.5*	
Siliceous sand	800	100	392	19
Ratio . . .	*8 : 1*		*21 : 1*	
Calcium carbonate. . . .	30	30	14	5
Ratio . . .	*1 : 1*		*about 3 : 1*	
Clay	110	50	57	10
Ratio . . .	*2 : 1*		*about 6 : 1*	

N. B. The actual densities used in the reduction of the weights into volumes are: siliceous sand, 2.65; calcium carbonate, 2 7; clay, 2 5; humus, 1.23.

Another table compares the results of mechanical analysis expressed in weight and in volumes for stony, sandy, clayey and humous soils.

The volumetric composition of soils would be made much clearer if represented graphically, *i. e.* by projecting the volumes of the constituents on a square, which itself represents the projection, or the vertical side, of 1 cubic decimetre (1 litre).

Diagrams of this sort are given for some of the soils studied by Dehérain. Of course, the representation can be made more detailed by the insertion in the diagram of the volumes of the different constituents of the mineral soil. This kind of diagram is especially adapted to agricultural maps, which it would render more explicit.

Finally, it would also be of importance to determine the *surface* of

the soil particles in the volume unit, as this information is of the highest practical importance and would usefully complete the volumetric data.

Summarizing, the writer concludes:

1. Representation by volumes gives a more faithful picture of the actual constitution of soils *in situ* than can be obtained by the usual representation by weight. The comparison of different soils is also made easier and more accurate.

2. It is necessary to represent the volumes of the air and the water, as well as that of the soil itself. Thus, an exact estimate is obtained of the actual water capacity of the soils *in situ* and knowledge of the volume of the pores (maximum water capacity and space left for the roots).

3. In order to realise uniform and comparable conditions of compactness, it is best to obtain the type samples of the soils by means of a wide cylindrical borer (of 1 litre capacity) from land which has long been undisturbed, or failing this, from well-rolled fields.

4. To express accurately the actual constitution of very coarse soils, the volume unit taken must be sufficiently large to contain them and to give a sufficient approximation (0.05 to 1 cubic metre).

5. The volumetric constitution of soils is made clearer by means of diagrams representing the projection of the volumes of the constituents on the vertical side of 1 cub. decimetre (1 litre), or of a multiple of this unit. These diagrams are also suitable for agricultural maps.

1608 – **Effects of Continuous Cropping and Rotations on the Bacterial Flora of the Soil.**

BROWN, PERCY EDGAR. Bacteriological Studies of Field Soils II: The Effects of Continuous Cropping and Various Rotations. (Contribution from the Soil Bacteriological Laboratory, Iowa State College, Ames, Iowa). — *Centralblatt für Bakteriologie, Parasitenkunde und Infektionskrankheiten*, Vol. 35, Nos. 11-13. Jena, September 16, 1912.

In many parts of Iowa it is a common practice to grow the same crop year after year on the same soil. This is especially the case in the west, where the soil is still so rich that this practice has as yet not resulted in decreasing crops, and also because on account of their superior value, many farmers persist in the wasteful system of continuously growing wheat or corn.

Investigators have shown that this continuous cropping of a soil will "wear it out" more or less quickly, and they have been striving for many years to convince the farmers that a rational system of rotation will yield them better crops and, at the same time, conserve the fertility of the soil for future generations.

The rotations usually used in Iowa are either a three-year rotation of corn, oats and clover, or a four-year one of corn, corn, oats and clover. In the case of soils deficient in humus, it is a common practice, after a cereal crop, to plough in a leguminous plant as a green manure.

The causes of soil fatigue, resulting on continuous cropping and the maintenance of soil fertility by rotation is, as is well known, one of the most vexed agricultural questions of the day. In place of the old hypothesis, that different crops require different nutritive substances, the Bureau of Soils has brought forward the theory of the excretion of toxic substances by the roots. The writer, on the other hand, believes that the reduction of the crops and exhaustion of the soil where continuous cropping was practised, was bacterial rather than chemical, or perhaps bacterial and chemical in nature. In other words, it is conceivable that the depletion of bacterial food in the soil might depress the activities of the organisms, so that the succeeding crop would not be sufficiently supplied with food to be able to produce a normal yield.

In the course of these researches, the chief problems to be solved are the following: does continuous cropping reduce bacterial activity in the soil? And on the other hand, do different methods of rotation encourage, or hinder, the development of such bacteria? Once these questions are answered, it will be possible to determine more accurately the causes which make bacterial action vary.

The investigations described in the present work were carried out at the Bacteriological Laboratory of Iowa State College at Ames, and had for their object the solution of the first-mentioned problem. They proved that bacteria are greatly affected by different systems of cropping and may thus be held largely responsible for the effects produced by continuous cropping and different rotations.

The experiment plots were twelve in number, one-tenth of an acre each, and located on drift-soil.

The bacteriological examination of the soil consisted in determinations of the number of organisms present in the soil at the various samplings, by counting the colonies developing on agar plates and in determinations of the ammonifying, nitrifying, and nitrogen-fixing powers of the soil.

The writer proposes continuing these researches and, in the meantime, he has come to the following conclusions:

1. The rotation of crops caused the development of greater numbers of organisms in the soil and of greater ammonifying, nitrifying and nitrogen-fixing power by the soil, than continuous cropping either to corn or to clover.

2. Greater numbers of organisms, and greater ammonifying, nitrifying, and nitrogen-fixing powers, were found in a soil under a three-year rotation of corn, oats, and clover, than in a soil under a two-year rotation with clover, cowpeas or oats turned under as green manure.

3. The use of a green manure in a two-year rotation did not always increase the number of bacteria or the ammonifying, nitrifying, or nitrogen-fixing power of the soil, and it is suggested that the explanation may

be sought in the moisture factor or it may be found in the introduction of such large amounts of organic matter.

4. There was an indication that the crop present on the soil was of more importance from the bacterial standpoint than the previous cropping of the soil.

5. The ammonification of dried blood and of cottonseed meal did not always run parallel.

6. The nitrification of dried blood and of ammonium sulphate proceeded almost parallel.

7. Nitrification and ammonification proceeded in the same direction.

8. Evidence is supplied that bacterial activities and crop production are very closely related.

1609 – Lateritization of the Soil under Arid Climates.

ULPIANI, C. Sulla laterizzazione dei terreni a clima arido. — *Stazioni sperimentali agrarie italiane*, Vol. XLV, Part 9, pp. 629-658. Modena, 1912.

In a lecture in which the writer summarizes all the theoretical views connected with astronomy, geology and anthropology which throw light on the origin of deserts, he examines the lateritization of the soil, which according to him appears due to a chemical process characteristic of soils under hot climates. The hypothesis that deserts are caused by diminished rainfall in such regions should therefore be abandoned, all the more as the quantity of rain that falls over a given area is not only regulated by the presence or absence of vegetation : but especially by causes which in the last thousands of years cannot have undergone any change, such for instance as the ratio between seas and dry land, the direction of the prevailing winds, of the chains of mountains, etc., etc.

Of late years our knowledge of the chemical phenomena which accompany the formation of the soil has been deeply modified. The investigations of Bauer have shown that the laterites which are so frequent in tropical countries, are formed by a process of superficial decomposition of aluminiferous rocks, which is the opposite to that which leads to the formation of common clay from the same rocks. In lateritization, laterite, which is a silicate of aluminium different from our clay and very rich in hydrate of iron, is formed by a lixiviation which removes the silicic acid and the alkalis, leaving the hydrates of iron ; whilst our agricultural clay is formed by a process which leaves the silicic acid in combination with hydrate of aluminium, whilst the hydroxides of iron are leached out.

Schloesing observed in 1901 that whilst samples of 5 grams of earth taken in France and boiled for half an hour with half a litre of a solution containing 3.5 grams of soda (Na_2O) yielded soda solutions containing small quantities of alumina, much less than 1 per cent., the soils collected in Madagascar yielded considerable quantities of this substance, up to

10 and 15 per cent. Lastly, Van Bemmelen in 1910 proposed a method for recognising whether, in a soil, clay or laterite prevailed. Van Bemmelen's method consists in treating the soil with concentrated hydrochloric acid and soda, and in the quantitive determination of the silica and alumina dissolved under these conditions. If the ratio $\frac{\text{molecules } SiO_2}{\text{one molecule } Al_2O_3}$ is greater than 3, the soil is clayey; if it is smaller than 3 it is a laterite.

Following this method the writer has investigated the soils of Southern Italy and sands and agricultural soils of Libya. The samples of soils collected in the provinces of Lecce, Foggia, Potenza and Teramo, as well as those of Libya, are to be classified as lateritic. In the silt deposited by the intermittent torrent Mecgenin on the Tripoli oasis during the last flood of November 1911, the ratio was 0.84, as in the most typically lateritic silts examined by Van Bemmelen.

The process of the formation of laterite extends therefore not only to the warm and rainy equatorial climates, under which it is rendered more evident by an active process of lixiviation, but also to the climates of the subtropical and warm-temperate zones. In warm countries having an arid climate, of which the most typical are the deserts, the process of lateritization is not accompanied by lixiviation and the laterite remains *in situ* together with the other products of chemical decomposition and of mechanical disintegration. The presence of laterite is further rendered less apparent by the action of the winds, which keep the surface of the soil always dry and dusty; this again facilitates the action of the wind in removing all the colloidal materials produced by chemical decomposition.

According to the writer, high temperatures essentially determine the process of lateritization. Rocks containing alumina, as for instance feldspars, under cold and cold-temperate climates, yield as products of decomposition on weathering, clay, silica and potassium silicate; whereas under hot climates, either moist or dry, the clay is still further decomposed into silicic acid and aluminium hydrate. The formation of laterite does not appear to be, as Bauer thinks, an action contrary to the formation of clay, but rather a further stage of the decomposition of aluminiferous rocks.

Clay soil is distinguished from laterite soil by its swelling when wet, and thus retaining water, which stagnates on the surface or collects into rivulets; also by keeping moist for a length of time, so that it allows the seeds it may contain to sprout. Laterite on the contrary is not plastic, it does not swell in contact with water and thus forms an exceedingly porous and permeable soil. But the chief difference between clay and laterite soils consists in their behaviour on exposure to the air and more precisely in their way of drying. The great plasticity of clay allows of the formation of clods larger or smaller, but coherent, tenacious, compact

and impermeable to air and which stand the action of the wind without undergoing any change of shape. Laterite soils on the other hand dry with great rapidity and turn to a fine incoherent dust ; this is no drawback in those equatorial countries enjoying abundant and regular rains, in which vegetation is most luxuriant, but it creates deserts under dry climates, because the extreme rapidity with which the surface dries hinders the sprouting of seeds. Where the degeneration into desert, due to the formation of laterite, has begun in regions where other pre-existing geographical and climatic conditions render rainfall scarce, it tends always to become more intense, because with the decrease of vegetation the strata of the atmosphere become always drier and the rains still scantier.

Hillgard, Director of the Agricultural Station of California, parts of which State possess a decidedly arid climate, is of opinion that the soils of dry countries are much more fertile than the soils of moist climates, because they are more porous, permeable and deep and offer plants a much greater mass of soil and a nutritive solution much richer in salts. In dry lands the soil has no importance and serves only to protect the underlying moisture against evaporation : it is into the immense and free depths of the subsoil at many yards below the cultivated layer, and in truly marvellous hygienic conditions, that plants send their roots in the search for nourishing water. Of course it is not everywhere that conditions are so favourable. Recourse is then had to dry-farming and to irrigation, and thus the North Americans have transformed the problem of the struggle against the desert into a hydraulic problem and have succeeded in obtaining splendid results.

According to the writer, the main difference between the agriculture of cold moist regions and that of warm dry ones is in the inverse values of the soil and subsoil. In the first the soil is the substratum in which plants that easily take root, live and grow until, on reaching maturity, they compete with each other. In the latter, plants do not easily take root, but if the roots succeed in reaching the subsoil they develop freely and attain a much greater development than in moist countries.

In conclusion, at the surface of the earth, since the glacial epoch, owing to the formation of laterite, the stock of clay in the soils of hot countries has been gradually diminishing. Two different types of agricultural soil have been originated: superficial and compact clay soils, special to the cold and cold-temperate zone ; the other consists of the deep and permeable laterite soils of the hot and warm-temperate zone. For each type of soil there exists a different form of agriculture, each having its special needs. Thus, if in clay soils there is a lack of air, deep ploughing and drainage are required ; if in laterite soils there is a lack of moisture, dry-farming and irrigations become necessary.

1610 – **The Determination of Humus, especially in Heavy Clay Soils** (1).

BEAM, W. in *The Cairo Scientific Journal*, Vol. VI., No. 68, pp. 93-103. Alexandria, May 1912.

An investigation into the methods of determination of humus has been undertaken in the Wellcome Tropical Research Laboratories, with a view to their application to the Sudan heavy clay soils.

The chief suggestions made are :

1. In the case of heavy clay soils and especially those containing little organic matter, washing with water until the filtrate is neutral cannot be relied upon to remove the excess of hydrochloric acid remaining after the extraction of the calcium.

2. The form of filter best suited to the complete removal of the acid, and also to the ready and complete extraction of the humus by ammonia, is that furnished by a Buchner funnel and the use of a layer of asbestos as well as a supporting disc of paper. The soil should be mixed with sand and the mixture covered by a layer of sand and a protecting disc of filter paper.

3. The removal of the hydrochloric acid is best accomplished with a cold solution of carbon dioxide, in order to avoid puddling the clay. In cases in which the humus is very low, the use of carbon dioxide water and the filter described above, was found to be the only practicable method of carrying out efficient filtration.

4. Complete extraction of humus from soil can only be accomplished by repeated treatments with the ammonia solution. Methods depending upon a single extraction with a measured volume of ammonia yield results below the truth.

5. The removal of clay from suspension in humus solution is readily accomplished by the use of ammonium carbonate, as suggested by Rather, but the clay so precipitated carries with it a portion of the humus.

6. With suitable precautions the use of ammonium carbonate offers a reliable and satisfactory method for removing the clay from the humus solution.

7. For the reasons given in 4) and 5) the modified " official " method suggested by Rather, (precipitation of clay by ammonium carbonate) may, in the case of soils poor in humus, give results as much as 50 per cent. below the truth.

8. Unless the greatest care is taken to avoid too long heating of the dried humus residue, and frequently notwithstanding such care, the Mooers-Hampton method (removal of the suspended clay from the humus solution by evaporating to dryness over a steam bath) fails when applied

(1) See No. 1144, *B.* Aug. 1912. (*Ed.*).

to Nile soils. Complete solution in ammonia after evaporation to dryness cannot always be effected.

9. The humus of Nile soils which have been examined up to the present is capable of exact determination by colorimetric estimations, which, properly checked by occasional gravimetric determinations, may serve a useful purpose in rapid survey work.

1611 – The Solubility of the Manganese in the Soils of Mauritius.

DE SORNAY, P. La Solubilité du Manganèse des Sols. — *Bulletin de l'Association des chimistes de sucrerie et de distillerie*, Vol. XXX, No. 3, pp. 96-100. Paris, September 1912.

According to the writer, Assistant-Director of the Agricultural Station of Mauritius, the soils of this island contain soluble manganese, and as it occurs in most of the plants, it is permissible to suppose that this metal exists there in an assimilable form. It is, however, difficult to specify the states in which manganese is present in the soils : from some it can only be extracted by strong acids, while from others it can be obtained by treatment with very weak acids, and even with water.

M. Bonâme, Director of the Station, has published in his annual report a series of analyses of the soils of Mauritius, and the results are very divergent, with the extremes of 0.409 and 0.0267 per cent. of manganese. Other investigations confirm these results, and the average percentage of manganese in the soil has been found to be from 0.150 to 0.200. In the first, as in the second series, the amounts of manganese varied for the same locality, as did the proportion of manganese soluble by weak and strong acids.

In the nitrification experiments commenced in 1897 and continued in 1898 and 1899 by M. Bonâme, it was found that, in the absence of a base, such as lime or ammonia, the manganese combined with the nitric acid formed. It is possible that the nitric acid formed in nitrification combined with the manganese, in spite of the presence of some lime in the soils, which would show that this metal is readily attacked.

The experiments of the writer showed the greater, or less, solubility of the manganese in the soil. The results are shown in Table I. The method was a follows : 100 gr. of dry soil were digested with 500 cc. of a 2‰ solution of nitric acid for 24 hours, with frequent shaking during the first 10 hours.

TABLE I. — *Manganese per* 100 *parts of soil.*

Total Manganese	Manganese soluble in 2‰ nitric acid	Manganese soluble in water
0.200	0.0161	traces
0.218	0.0075	,,
0.189	0.0013	,,
0.233	0.0184	none
0.193	0.0008	,,
0.265	0.0102	traces
0.239	traces	none
0.112	0.0024	traces
0 387	0.0047	,,
0.118	0.0063	none
0.108	0.0085	traces
0.322	0.0097	,,

The aqueous solutions were placed under the same conditions as the weak acid solutions : the amounts found were too minute to be estimated, but the liquids were sufficiently coloured to testify to the presence of manganese.

On the other hand, a series of researches made by M. Bonâme on plants belonging to different families, as well as a second experiment made by the writer on Leguminosæ, show that manganese is easily obtained from the soil by plants. Table II shows the proportion of manganese to the ash, the dry matter and the fresh material.

TABLE II. — *Manganese in Plants.*

Plants Analysed	Manganese		
	to 100 parts of ash	to 100 parts of dry matter	to 100 parts of fresh material
Maranta arundinacea	1.155	0 087	0.012
,, (dried leaves)	0.504	0.044	0.010
Thea sinensis (leaves)	0.898	—	—
Rice (stalks)	0.113	0.014	0.005
Ipomœa batatas (lianas)	0.245	0.030	0.003
Musa paradisiaca	0.376	0.033	0.006
Vanilla	0.380	0.036	0 004
,,	0.680	0.065	0.009
Cane (stems)	0.371	0.007	0.002
,, (leaves)	0.174	0.013	0.003
Vigna catjang	0.500	0.043	0.009
Lathyrus (Dholl)	0.180	0.011	0.010
Voandzeia subterranea	0.553	0.053	0.015
Phaseolus lunatus	0.341	0.025	0.005
P. helvolus	0.380	0.028	0.006
Arachis hypogea	0.206	0.023	0.005
,,	0.330	0.030	0.007
Caesalpimia sappan	0.174	0.014	0.004
Crotalaria retusa	0.090	0.008	0.003
Canavalia ensiformis	0.090	0.009	0.003
Tephrosia candida	0.090	0.013	0.003

In the Leguminosæ, he thus found as much as 15 mg. of manganese per 100 grams of fresh material, which is a considerable amount.

The writer investigated the manganese in the seeds of the Leguminosæ and, though he did not estimate the amount, it was present often in sufficient proportions to admit of determination, and in all cases, traces existed. The pods seemed free from manganese, for most of the experiments gave negative results.

This metal is, therefore, soluble in water and in very weak acid solutions in the soils of the different districts. It is probable that the manganese of the soils of Mauritius is easily assimilable, seeing that: 1) water and very dilute acid solutions remove it; 2) plants assimilate it naturally, and their ash often contains fairly large amounts of this substance.

It is difficult to determine the states in which the manganese is present in soils, as they are capable of modification, and the metal may form soluble or insoluble salts. In some soils, especially those of volcanic origin, it is possible that the acids formed during the decomposition of organic matter dissolve certain elements, such as manganese, and combine with them.

In the course of the investigation of soils by means of aspartic acid, it was found, in a number of cases, that a determinable amount of manganese was dissolved; this implies that, since this metal is easily acted upon by organic acids, under certain conditions, plants should assimilate it without difficulty.

Thus, it is probable that manganese has some physiological effect upon the plant.

PERMANENT IMPROVEMENTS DRAINAGE AND IRRIGATION.

1612 – The Problem of Irrigation in the Tonking Delta.

CHASSIGNEUX, E. L'irrigation dans le delta du Tonkin. Ses conditions géographiques. — *La Géographie. Bulletin de la Société de Géographie*, XXVI, No. 3, pp. 177-202. Paris, September 15, 1912.

Soil. — The plain of the Tonking delta has been formed by the Red River and the Thai-binh * which have filled up a shallow gulf with their alluvial deposits. On the rock which was the old bottom, there is a layer of stones and gravel, covered in its turn by clay, sand and mud. The surface is very poor in humus and lime; the soil has become exhausted from centuries of impoverishing cultivation and contains very little lime and phosphoric acid. When dry it is exceedingly hard and compact and when wet it is absolutely impermeable. As it lacks consistency it affords a bad foundation for large masses of masonry; on the other hand it lends itself well to the construction of simple earth works.

*) In the geographical names the French orthography has been retained.

Climate.

Average monthly rainfall at Hanoi (Average of twenty years).

	Jan.	Feb.	March	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Year
mm.	13	26	58	82	160	230	308	320	247	149	45	21	1659

Average monthly evaporation (Average 1907-1910).

mm.	58.8	28.7	48.5	44.6	82.2	87.2	109.6	74.8	69.6	80.5	91.7	84.8	861.0

There are however very considerable variations from year to year.

In general the summer is fairly moist. Violent intermittent showers pour torrents of water on the country ; the swollen rivers threaten to break their embankments and to flood the plains. The soil is mostly saturated with water, but exceptionally dry spells come on, during which the heat and evaporation are intense. The winter, which is relatively drier, is divided into two periods. The first from November to January is dry with cloudless skies ; the great rivers are at their lowest level ; nevertheless the soil retains considerable reserves of moisture due to the abundant summer rains. When these reserves begin to be exhausted, in February and March, the second period, characterised by low barometric pressures, much mist, great relative humidity and fine rains, brings some moisture to the soil. Nevertheless longer or shorter periods of drought are more frequent if not more harmful in winter than in summer.

The irregularity of the climate is all the more injurious inasmuch as the principal crop grown in the Tonking Delta is rice, which perishes if it is without water for more than ten days or if it is flooded for more than seven.

There are two rice seasons in the year : the principal one is from July to November, in which sowing takes place at the end of June, planting out at the end of July or in August, and harvesting in November, the tenth month of the Annamite calendar, whence the name of " tenth month crop "; the secondary rice season extends from December to June. The soil is prepared and sown in December to January. Planting out is performed in February and harvesting in May to June (fifth month crop). The high-lying rice fields, which are irrigable only in summer, yield the tenth month rice and during the winter are put to potatoes, beans, taro, etc. The low rice fields, being flooded throughout the rainy season, are used for fishing ; at the beginning of winter, water reserves are formed and during the dry season fifth month rice is grown. As for the medium level rice fields, there is no certainty about their giving either a summer or a winter crop. Both are attempted but they are both risky. Even when neither of the two crops is lost, the double amount of work, manure and seed barely produces ⅓ or ¼ more rice than the other classes of rice fields.

The rice crop in Tonking is always somewhat risky. The tenth month

crop cannot be planted out before the first rains have softened the soil sufficiently to allow its being ploughed ; if planting out is done too late there is danger of having the tender plants swamped by the first flood. If the summer is too dry, not only is the tenth month crop lost, but for the want of reserves of water at the end of the winter it becomes impossible to grow the fifth month crop. For this reason dry years are famine years ; they are not frequent, but terrible when they occur.

Irrigation is oftener necessary for fifth month rice than for the tenth month fields ; but the latter require a greater quantity of water per second per acre. Experiments made in the Kep plain have shown that the quantity of water required in winter may be reduced from 0.062 gals per second per acre in December, to 0.022 in February and March.

The Annamite system of irrigation is very ingenious, but it has the capital defect of utilizing only the small watercourses : the natives did not dare to deviate the water of the larger rivers for fear of inundations. The French Government has undertaken to solve this part of the problem.

Tonking may be divided into three regions differing somewhat from each other in their geographical conditions : the upper delta and middle region of northern Tonking ; the central delta region ; and the maritime belt.

The first of these regions, owing to its regular fall, to its rocky subsoil capable of bearing heavy masses of masonry and to the fact that its rivers, in spite of their floods, are much more manageable than the Red River, is suitable for great irrigation works and particularly for irrigation by gravity. These works consist in a barrage across the river to raise the level of the water and in a network of canals. The first and hitherto only work of this kind is the Kep canal, which waters the country between Kep and Phu-lang-thuong in the province of Bac-giang. The Song-Thuong has been dammed at Cau-Song by a complete stone barrage, over which flows the water that is not taken up by the canal. The main canal is about 15 miles long and conveys 247 cubic feet per second which it delivers into secondary canals measuring altogether 24 miles and feeding in their turn 217 miles of distributing channels.

This work has given noteworthy results : the tenth month rice crop, which was formerly often damaged by drought, is now ensured, and it has extended from the 9880 acres on which it was grown in 1908 to 13 338 in 1910. The fifth month crop has increased from 890 acres in 1908 to 8200 in 1911. Encouraged by these results, plans for similar works have been drawn up and are about to be carried out on the Song Day, Song Luc-nam and Song Cau rivers, which will supply water for the irrigation of about 150 000 acres.

The maritime belt of the delta is constituted by long strips of sandy ground from a few inches to six feet high — old coast lines — running

from North-East to South-West, and separated from each other by depressions, the soil of which being more recent river silt is more clayey, and is occupied exclusively by rice-fields.

This belt is the richest in moisture, having a rainfall of 1 500 to 2 000 mm. (60 to 80 inches) besides being the most irrigated ; the neighbourhood of the sea renders harmless the floods of the great rivers, the level of which follows the tides in the gulf. Taking advantage of the rising tides, the river water is allowed to enter the irrigation canals, which are provided with sluice gates made of " lim ", a very hard and durable wood. Too near the coast however the salt water mingles with the river water, rendering it unfit for irrigation. In the province of Kien-an, during the winter no irrigation can take place at low tide because the level of the river is too low, nor at high tide because the water is brackish. In summer the mass of river flood water is sufficient to repel the sea water, which is met with only at the mouth of the river and in the lower strata owing to its greater density ; the superficial water, being fresh, is allowed to enter the canals through the sluice gates, which are very numerous, but each serves a very limited area. They also allow the land to be drained at low tide. The system has been perfected by the French protectorate. The area to be guarded against the salt water on the one hand and against floods on the other, is divided into sections surrounded by embankments on all sides : those near the river have sluice gates which allow the entry of the fresh water ; those near the sea prevent the sea water from entering, but allow at low tide the outflow of the surplus of fresh water. Extensive works of this kind have been carried out in the provinces of Kein-an, Thai-binh and Ninh-binh; other complementary works are in course of construction.

The central region of the delta is the most extensive and the one that presents the greatest difficulties to the solution of the irrigation problem. It is traversed by the Red River with its numerous branches, which, with the silt they carry down, have formed on their banks small natural ridges a few yards high and some hundreds in width. They diminish in height as the sea is approached and separate the river from the two long series of lagoons between them and the foot-hills and which are fed by the torrents descending from the mountains.

Thus two perfectly independent hydrographical systems are to be distinguished : one belonging to the Red River increased by the waters of the Clear River and the Black River, the other the system of the small independent basins along the river embankments. The irrigation problem is thus a double one : to provide the rice fields with water at certain periods of the year and in others to drain the lower levels of the excess of water which renders them unsuitable for growing crops during half the year. The side ridges along the rivers, capped by high embankments

as protection against floods, in winter completely isolate the course of the river at low water from the neighbouring low rice fields, preventing irrigation by gravity. In summer the river, being in flood, flows at a higher level than that of the country, and irrigation by gravity would be possible, but on opening the embankments the danger would be incurred of flooding whole provinces. For this reason the natives have limited themselves to using the waters of the small independent basins.

The French protectorate has undertaken the solution of the double problem of drainage and irrigation. In order to suppress the temporary lakes which cover the delta at the end of the summer their water is collected in deep canals which convey it directly to the sea. Sluices regulate the quantity of water to be drained off or to be kept for the fifth month crop; strong embankments protect the canals against the floods of the large rivers. Works of this type have been carried out or are in progress in the provinces of Ha-dong (southern part), Ha-nam, Son-tay, Vibh-yen and Bac-Nih.

In order to solve the problem of irrigation proper, the water of the Red River has to be raised artificially. One project contemplated a barrage at the beginning of the delta, and another one a steam pumping station, but neither have been executed, the first because the construction of massive masonry edifices is not possible on the inconsistent soil of the delta; the last project, which has been drawn up and for which a considerable loan has been demanded, consists in the excavation of a network of canals in each small basin, with a pumping plant at the head of each main canal. A large central electrical station would distribute high tension electric energy, by means of overhead wires, to the various pumping stations. This project gives due consideration to the various levels of the different parts of the country and provides also for the completion of the drainage in the low-lying lands in all those cases where gravity alone is not sufficient.

MANURES AND MANURING.

1613 – **The Extraction of Potash from Silicate Rocks in the United States.**

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WORLD SITUATION.

The potash-bearing silicates are among the most widely distributed minerals as constituents of nearly all crystalline or volcanic rocks. The principal minerals of this class from the point of view of the potash which they contain are orthoclase or microcline, muscovite, leucite and sanidine. Millions of tons of rock containing one or more of these minerals with an average potash content of nearly 10 per cent. are to be found widely distributed all over the globe. It is for this reason that the igneous minerals, particularly the potash feldspars, are so often mentioned as a source of potash salts.

Perhaps the best known of these deposits are those of leucite in Italy, of phonolite in Germany, of sanidine in France, and of muscovite in Russia. But, not considering at present the question not yet solved of the direct utilization of these minerals as potash fertilisers, it may be of practical interest to summarize the state of the researches made in the United States, with a view to extracting potash from silicates on an industrial and commercial basis. Up to date these researches are perhaps the most extended; besides giving useful secondary products theya re directed to obtaining the potash in a soluble form for immediate use in agriculture, as in the common potash salts employed.

UNITED STATES SITUATION.

The potash-bearing minerals of the United States may conveniently be divided into three classes, as follows: 1) Alunite and similar minerals; 2) the greensand marls; and 3) the igneous rocks.

Alunite is a hydrated sulphate of aluminium and potassium. It differs from the minerals of the other two groups in that the potassium is readily available by simple ignition of the mineral to a dull red heat. When occurring in sufficient quantity and purity alunite is thus a possible economic source of potash and has long served as a source of potassium alum in Italy and other countries. Its occurrence in this country is limited to

TABLE I.

Analyses of Potash-bearing Minerals.

	1	2	3	4	5
$Si O_2$	0 22	51.56	65.87	44.39	50.23
$Ti O_2$	—	—	—	—	2.27
$Al_2 O_3$	37.18	6.62	19.10	35.70	11.22
$Fe_2 O_3$	traces	15.16	—	1.09	3.34
Fe O	—	8.23	—	1.07	1.84
Mg O	—	0.95	none	—	7.09
Ca O	—	0.62	0.20	0.10	5.99
$Na_2 O$	0.33	1.84	2.56	2.41	1.37
$K_2 O$ (potash)	10.46	4.15	12 24	9.77	9.81
$H_2 O$	12.99	10.32	0.64	5.88	2 65
$P_2 O_5$ (phosphoric acid)	0.58	—	—	—	1.89
$S O_3$	38.34	—	—	—	0 74
Fl.	—	—	—	0.42	0,50
Other constituents	—	—	—	—	1.68
	100.10	99.55	100.61	100.83	100,62

(1) Alunite from Marysvale, Utah. Selected specimen. Analysis by W T. Schaller, *Bull. U. S. Geol. Survey*, No 511, p. 8.

(2) Glauconite from greensand marl, Hanover Co. Virginia. Analysis by M. B. Corse and C. Baskerville, *Am. Chem. Jour.*, 14, p. 627.

(3) Ground commercial feldspar from quarry of J. B. Richardson and Sons, Bedford, Ont. Analysis by George Steiger, *Bull. U. S. Geol. Survey*, No. 420, p. 9.

(4) Muscovite from Auburn, Maine. Analysis by R. B. Riggs, *Bull. U. S. Geol. Survey*, No. 419, p. 286.

(5) Leucite-bearing rock, Wyoming. Analysis by W. F. Hillebrand, *Bull. U. S. Geol. Survey*, No. 512, p. 11.

comparatively small deposits in Utah, Colorado, and Nevada, the largest so far known, near Marysvale, Utah, having been recently described.

Greensand, or glauconite, is essentially a hydrated silicate of iron and potassium, but it is extremely variable in composition and never occurs pure. It is formed through the interaction of various alteration products, and organic matter is believed to play a part in its formation, which would

explain its occurrence in the marl deposits of Kentucky, New Jersey, Tennessee, and other States. Like the minerals of the third group it is a refractory silicate, and the potash which it contains is not readily available.

The igneous rocks form, as above said, perhaps the most important source.

In table I are given sample analyses of the most important potash-bearing minerals in the United States.

Potash Extraction from Silicates.

The desirability of finding some economical way of extracting potash from these minerals has long attracted the attention of various investigators, and numerous patents have been issued covering processes which are claimed to solve this difficult problem. The increasing yearly demand for potash salts in connection with artificial fertilizers has of late renewed interest in this direction, and in some cases companies have been organized for the purpose of manufacturing potash by one or other of the various processes which have been proposed, but up to the present no potash prepared in this way has been placed on the market. Practically all methods yet proposed, in principle at least, have been covered by patents. A comparative study was therefore undertaken of all the processes for which patents have been allowed, with a view to finding what methods, if any, give promise of being practicable commercially.

Of the many patents which have been issued for extracting potash from silicate rocks, the essential feature of at least four (H. S. Blanck, No. 513 001, 1894; G. Y. Rodin, No. 641 406, 1900; R. H. Mckee, No. 869 011, 1907: A. S. Cushman, No. 987 435, 1911), consists in heating the potash-bearing material with calcium oxide or carbonate, and calcium or sodium chloride.

From a comparative study which was made of these patents it does not appear that the use of sodium chloride has any advantage over calcium chloride. The latter is a by-product obtained in large quantities in the manufacture of sodium carbonate, and is somewhat more effective than the former in bringing about complete decomposition of the feldspar, but when limited amounts of the reagents are used more potash is rendered soluble with the use of sodium chloride than with calcium chloride. In Table II are given the percentages of the total potash in the feldspar which have been rendered soluble on heating a given amount of feldspar at 1000 deg. to 1050 deg. C. with varying amounts of calcium carbonate and calcium chloride, and with calcium carbonate and sodium chloride. The feldspar used in these experiments was ground to pass a 100-mesh sieve and contained 13.72 per cent. of potash, and 2.18 per cent. of soda.

TABLE II.

Showing percentages of alkalies rendered soluble when feldspar is ignited with varying amounts of calcium carbonate and calcium chloride, and with calcium carbonate and sodium chloride.

Feldspar	Calcium carbonate	Calcium chloride	Calcium chloride	Time of ignition	Soda obtained in percentage of feldspar	Potash obtained in percentage of feldspar	Percentage of potash in feldspar rendered soluble
gr.	gr.	gr.	gr.	hours			
1	1	0.25	—	2	1.8	8 2	59.8
1	1	0.50	—	2	1.6	9.4	68.5
1	1	0.25	—	2	1.8	10 7	78.0
1	2	0.50	—	2	2.0	13.0	94.8
1	3	0.25	—	1	1.8	10.8	78.7
1	3	0.25	—	2	1.8	10.9	79.4
1	3	0.50	—	1	2.0	13.0	94.8
1	3	0 50	—	2	2.0	13 2	96 2
1	3	1.00	—	2	2.2	13.6	99.1
1	1	—	0.25	2	—	9.4	68.5
1	1	—	0.50	2	—	11.2	81.6
1	2	—	0.50	2	—	11.7	85.3
1	3	—	0.25	2	—	9.4	68.5

In these experiments the results show that while a considerable portion of the potash was rendered available when using approximately the proportions of the reagents stated in the patents, the total potash in the feldspar was not rendered soluble in this way at the temperature specified. Thus, when 1 part of feldspar is ignited with 1 part of calcium carbonate and 0.25 part of calcium chloride, which is 0.05 part in excess of that equivalent to the alkalies in the feldspar, only about 60 per cent. of the potash in the feldspar is rendered soluble. Increasing the proportions of calcium carbonate and calcium chloride used produces a comparatively small increase in the amount of soluble potash obtained, and complete decomposition of the feldspar only takes place when one part is ignited, under the conditions of the experiment, with about 1 part of calcium chloride and about 2 to 3 parts of lime. When this proportion of the reagents is used, considerable variation in the temperature of igni-

tion will give the same results, and almost the entire amount of the potash is rendered soluble at a temperature below the melting point of potassium chloride.

The results obtained on igniting feldspar with lime and sodium chloride are in agreement with those published by Rhodin, the author of the patent covering this process, who only claimed an extraction of about 41 per cent. of the potash in the feldspar when using the proportion of the reagents stated in the patent, *viz.* 1 part feldspar, 1 part lime equal to 1.8 parts calcium carbonate, and 0.2 part sodium chloride. It was pointed out, however, that a more favorable result was obtained by using a larger amount of salt with a smaller amount of lime. Thus, when 100 parts of feldspar were ignited to 900 deg. C. with 40 parts of lime and 40 parts of salt, the result about corresponded with the value given in the table for approximately this proportion of the reagents.

Unless a large excess of calcium chloride is used, ignition with feldspar and lime produces no vitrification at a temperature up to 1 050 deg. C. The ignited mass remains in the form of a powder, and consequently the soluble material present can be readily leached out without the necessity of any previous grinding of the mass. The same statements hold true when sodium chloride is used, but with a more limited variation in the proportions of the reagents which may be taken. Thus, a hardened mass is obtained when 1 part of feldspar is ignited to 1 050 deg. C. with 1 part of calcium carbonate and 0.25 part of sodium chloride, but if the proportion of calcium carbonate is doubled the mass remains in a powdered form. When calcium chloride is used, the mass does not harden on ignition, even with 1 part of calcium carbonate.

On account of its simplicity, the method of decomposing feldspar by heating with calcium carbonate and with calcium chloride (or sodium chloride) could undoubtedly be carried out on a large scale without involving any serious mechanical difficulty, and the method would thus be a practical one providing the value of the products obtained would compensate for the expense involved. Although pure feldspar may be obtained which contains upward of 15 per cent. potash, the average grade of feldspar which could be mined on a large scale would undoubtedly contain less than 10 per cent. If potash be quoted at 66 cents a unit, then the potash in a ton of feldspar containing even 10 per cent. of this constituent would be worth only $6.60 when converted into a soluble form. It is thus evident that the value of the potash alone will not compensate for its extraction by this process, or by any modifications of it for which patents have been granted; not is it at all likely in view of the comparatively low percentage of potash in all silicate rocks that any process can be devised which will prove so simple that the value of the potash alone will pay for its extraction. It seems safe to say, therefore, that any me-

thod to be economical must produce at the same time other products of value in addition to the potassium.

Potash from Silicates as Bye-product.

One of the first patents on a process for converting the insoluble potash in feldspar into a soluble form was issued in 1856 to Charles Bickell (United States patent No. 16 111). The process consists in heating in a reverberator, or other suitable furnace, to a light red heat for about 2 hours, 1 part feldspar, 0.5 part phosphate of lime and 3 or 4 parts of lime, all in a finely divided state. According to the patent the potash becomes available by this treatment, and may be extracted in a caustic state by lixiviating with water, or the mass may be used directly as a manure. At first sight this process seemed particularly attractive, for if both the potash and phosphoric acid were rendered avilable by this treatment, as claimed by the patent, the method might be an economical one, since, when used as a fertilizer no separation of the constituents would be necessary, and the mixture would be of value for its phosphoric acid as well as its potash content. It was found, however, that the calcium phosphate has a passive effect in this treatment of the feldspar, and that no greater decomposition was produced in this way than when it was heated with calcium carbonate alone.

Thus when 1 gr. of feldspar, 0.5 gr. of calcium phosphate, and 3 gr. of calcium carbonate were mixed and ignited for two hours at 1 000° deg. C., the amount of potash rendered soluble only amounted to about 2 per cent. of the feldspar. The amount of soluble potash obtained when 1 gr. of feldspar and 3 gr. of calcium carbonate were ignited in the same way likewise amounted to approximately 2 per cent., but in each case the greater part of the residue remaining after extracting with water was decomposed when treated with dilute hydrochloric acid, the potash going into solution. When the temperature was increased to about 1 200 deg. C., the soluble potash amounted to 5 per cent. of the feldspar, and the extracted residue was then found to be readily and completely decomposed by hydrochloric acid. From this solution was obtained the remaining portion of the potash which did not dissolve on digesting with water. The crucible in which these ignitions were made was closed with a cap, and as this end of the crucible was not ignited, there was little tendency for the potash to escape, but when the ignition was made in an open platinum dish in a furnace at a temperature of about 1 400 deg. C., the potash in the feldspar was found to have been completey lost by volatilization. In carrying out this experiment the feldspar was first dried to constant weight by heating in a muffle furnace at 1 000 deg. C. The calcium oxide ussed was likewise reduced to constant weight by ig-

niting chemically pure calcium carbonate at a temperature of 1 400 deg. C. for several hours. One gram of the feldspar and 1.68 gr. of calcium oxide, equivalent to 3 grams of calcium carbonate, were then well mixed, and ignited in an open dish in the furnace at 1 400 deg. C. for one hour. The weight of the mixture was found to have decreased by 0.1606 gr., which is equal to 16 per cent. of the feldspar. The residue was then analyzed for potassium, but only a trace was found.

The experiment was then repeated, using ten times the amount of feldspar and a corresponding amount of calcium oxide. The same care was taken as before to reduce each constituent to constant weight before mixing. After igniting for one-half hour the loss in weight of the mixture amounted to 1.3912 gr., equal to 13.9 per cent. of the feldspar. On repeating the ignition for one hour a further loss in weight of 0.1630 gr. took place, which was increased to 0.1768 gr. on igniting for one hour longer, making a total loss of 1.5680 gr., equal to 15.7 per cent. of the feldspar. Since the feldspar was shown by analysis to contain 15.9 per cent. of potash and soda, it would thus appear that the greater part of the alkalies in the feldspar was driven off in the form of oxides. This was confirmed by an analysis of the residue, which contained less than 0.2 per cent. of total alkalies. The hardened mass remaining after ignition strongly resembled cement clinker, and that the product obtained by igniting feldspar and lime together contains all the essential elements of a cement is well known. Using the feldspar and lime in the proportions of 1 to 1.68, a clinker approaching the composition of Portland cement is obtained.

Thus, if 1 part of feldspar, assumed to contain the theoretical amounts of potash, alumina, and silica, loses the first-named constituent, amounting to 0.17 part when ignited with 1.68 parts of calcium oxide, or 3 parts of calcium carbonate, then the clinker which remains will equal 2.51 parts and will have the percentage composition given in Table III. In the second and third columns are also given the minimum and maximum limits of the constituents of good Portland cement.

TABLE III.

Comparison of the composition of feldspar-lime clinker with that of Portland cement.

Constituents	Feldspar-lime Clinker	Portland cement Minimum	Portland cement Maximum
Silica	25 8	19	26
Alumina	7.3	4	11
Lime	66.9	58	67
Ferric oxide	0	2	5
Magnesia	0	0	5
Sulphuric acid	0	0	2.5
Alkalies	0	0	3

This shows that all the constituents of pure feldspar-lime clinker lie between the limits allowable in a good Portland cement, and that ferric oxide is the only necessary constituent absent. If commercial feldspar and lime were used, however, this would no doubt also be supplied in sufficient quantity, and at the same time the silica and lime would be reduced more closely to the mean of that found in a good Portland cement, providing the feldspar does not contain an excessive amount of free silica.

In order that a clay may be suited for the manufacture of cement, it should have a percentage ratio of silica to alumina of from 3 to 1 to 4 to 1. The ratio of these two constituents in feldspar is 3.5 to 1. In muscovite and leucite of theoretical composition the proportion of silica to alumina is less than 3 to 1, but in commercial samples of leucite-bearing rocks the ratio is usually greater than 4 to 1.

A clinker of the same ultimate composition as that which results when feldspar and lime are heated together may also be obtained when part of the lime is replaced by suffiicient calcium chloride to be equivalent to the potash and soda in the feldspar, the total calcium used remaining the same as before. In carrying out this experiment, the feldspar and lime were ignited to constant weight as already described, and the calcium chloride thoroughly dried by heating in an air-bath below its melting point. Ten grams of the feldspar were well mixed with 2.0050 gr. of calcium chloride and 15.7895 gr. of calcium oxide, and the mixture then ignited in an open dish in the furnace at 1 400 deg. C. By this treatment the alkalies are volatilized as the chlorides. On igniting for one-half hour the weight lost by the ignited mass amounted to 2.5632 gr., equal to 25.63 per cent. of the feldspar. When expressed as the chlorides the percentage of alkalies in the feldspar used amounted to 25.82 per cent. It would appear, therefore, that practically the whole of the alkalies in the feldspar were volatilized during the first half hour of ignition. On continuing the ignition for one hour longer the additional decrease in weight which took place amounted to only 0.0090 gr. The residue was then analyzed for potassium and chlorine, but only a trace of each was found. This shows that the volatilization of the potash in feldspar takes place more rapidly when part of the lime is replaced by calcium chloride than when the feldspar is ignited with lime alone, but in each case the ultimate composition of the residue obtained is the same. Any excess of calcium chloride used above that equivalent to the potassium in the feldspar is slowly decomposed at the temperature at which the ignitions were made, leaving behind the oxide of calcium.

Since the clay used in making cement contains in some cases as high as 3 or 4 per cent. of potash, it might be expected that part would escape from the kiln and be collected with the flue dust, particularly in those plants where the Cottrell process for collecting dust had been installed.

This has been observed by several investigators to take place, and the potash then collected is found to be in the soluble form. By the substitution of feldspar for clay in the manufacture of cement the potash then collected would, no doubt, be greatly increased, but since the analyses of cement show the presence of alkalies, it follows that with the style of kilns now in use the potash in feldspar could not all be made available in this way. That a larger proportion of the potassium would be volatilized by substituting for a part of the lime sufficient calcium chloride to be equivalent to the potassium is evident from the experiments already referred to, and experiments are now being undertaken on a large scale to compare the practicability of this procedure with the simple ignition of feldspar and lime alone.

According to the Census report for 1910, Portland cement manufactured in the United States during the year 1909 amounted to 65 000 000 barrels, or 13 000 000 tons, valued at approximately $53 000 000. The maximum quantity of potash which it would be possible to obtain by the use of feldspar in the manufacture of this quantity of cement can be calculated if the potash content of the feldspar is known. This varies up to about 16 per cent., but if half of this, or 8 per cent., be taken as the average percentage of potash in commercial feldspar, then 1 part of feldspar combined with 3 parts of calcium carbonate, equal to 1.68 parts of calcium oxide, would yield 0.08 part of potash and 2.6 parts of cement. Therefore 13 000 000 tons of cement would produce 400 000 tons of potash. Again, quoting potash at 66 cents a unit, this would have a value of $26 000 000, which is three times the value of the potash salts in the United States during the year referred to, and about twice the value of the imports for 1911. Whether or not this would cover the cost of the feldspar, its transportation, and the expenses incident to the recovery of the potash, can only be determined by experimentation on a large scale; but the probability that potash salts can thus be obtained in large quantities as a by-product makes this method of getting at the potash in feldspar quite promising.

1614 – **The Effects of Manures in the Various Types of Soil in the Sugar-Beet Region of Southern Russia.**

TULAIKOV, S. Dieistve Otdielnikh Pitatelnikh Vestchestvo Vnosimikh v Vidie Udobrenii na Raslicnago Tipa Pocvakh inxno-russkago Sveklosakharnago Raiona. — *Khosiaistvo* (The Farm), Year VII, No. 36, pp. 1177-1180. Kiev, September 13, 1912.

The present discussion on the problem of the effect of manures in the various kinds of soil is based upon the numerous data collected in 26 localities during the period from 1902 to 1910.

The soils in which the experiments were conducted may be divided into three groups.

1. — Black soils, "Chernoziom," containing upwards of 4 per cent of humus.

2. — Transition soils between black soils and forest loams. Humus content inferior to 4 per cent.

3. — Forest clays containing 2½ per cent. of humus.

In studying the effect of manures, taken singly or in mixtures, on the development and growth of young plants, on the roots and seed crop and on the cereals grown after beets, the writer has arrived at the following conclusions: that the soils of the beet region may be subdivided, independently of the stage of development of the plants, into two groups: 1) those soils which react to manures; and 2) those which do not or only in a very slight degree. The black and the transition soils belong to the first group, while the second group comprises the heavy forest clays of the Governments of Kiev and Podolia.

A. *Black soils.* 1. — An increase in the harvest of the several crops grown in the black soils is obtained especially by the application of phosphates.

2. — Favourable results from the use of potash alone are obtained, but rarely and almost exclusively in the light chernoziom loams.

3. — The effect of nitrogen applied alone is very limited in the black soils. The nitrogen of nitrate of soda serves in fact only to make up for the insufficiency of nitrogen in those soils in the spring, and plays a very secondary part in the further development of plants, for the quantities of nitrogen that are formed in the processes of nitrification are more than enough for the needs of the crops.

4. — The increase in the harvest due to the application of phosphoric acid and of potash together only very rarely exceeds the sum of the increases which are obtained from each of the above manures used separately. It happens however sometimes in the light loamy chernozioms.

5. — The increase of harvest due to a mixture of phosphoric acid and nitrogen tends to equal the sum of the increases that would be obtained by each of the two manures separately. Effects superior to the arithmetic sums are obtained sometimes in the chernozioms of the Sadnieprovskii district.

6. — The feeble action of potash and of nitric nitrogen used separately is not enhanced by using them together.

7. — The increase of crop obtained by applying phosphoric acid, potash and nitric nitrogen is about the same as that obtained with the mixtures of phosphoric acid and potash or of phosphoric acid and nitric nitrogen.

B. *Transition Soils.* 1. — These behave towards phosphatic manures similarly to the black soils.

2. — The effect of potash alone is relatively superior to that observed on the chernoziom.

3. — The need of nitric nitrogen is greater than in the black soils; consequently the favourable results from the use of nitrate of soda alone are more frequent.

4. — A mixture of phosphatic and potassic manures has the same effect as in the blacks soils.

5. — The effect of a mixture of phosphoric acid and nitrogen is more evident.

6. — The simultaneous use of potash and nitric nitrogen gives positive results, superior to those due to the application of only one of the above substances.

7. — Complete manuring, that is with nitrogen, potash and phosphoric acid, does not yield better results than manuring with only two elements.

C. *Forest Clays.*1. — The effects of manuring in these soils are much inferior to those which take place in the black and in the transition soils.

2. — The best results are those due to the use of phosphoric acid.

3. — Equally satisfactory results are often produced by the nitrogen of nitrate of soda.

4. — The action of potash is less beneficial than that of phosphoric acid or of nitric nitrogen.

5. — Mixtures containing only two fertilizing elements as well as complete manures do not give any better results than the single fertilisers used separately.

As general conclusion it may be stated that the relation between soil and manure is connected with the group to which the soil belongs, independently of the crop grown.

1615 - The Effect of Fertilisers on Cotton.

The American Fertiliser Hand Book, 1912, p. 68. Philadelphia, 1912.

The following indicates the beneficial effect of fertilisers on cotton, as shown by U. S. Census data.

The cotton States are divided into two groups: *a*) those in which atificial fertiliser is generally used, *viz.* Virginia, North Carolina, South Carolina, Georgia, Alabama and Tennessee; *b*) those in which fertiliser is not generally used, *viz.* Oklahoma, Texas, Arkansas, Mississippi and Florida, but considering the virgin territory of Oklahoma separately. Taking the largest crop prior to 1909, *viz.* 1898-99, against the largest crop since, *viz.*, 1911-12, the comparison is shown in the table below.

These figures are really startling in revealing the extent to which the increase in cotton production is dependent upon the use of fertilisers. They show that in the unfertilised States an increase of 51 per cent. of

acreage has resulted in an increase of only 22 per cent. in yield ; that in the older unfertilised States an increase of 38 per cent. in acreage has resulted in an increase of only 12 per cent. in yield ; while in the fertilised States an increase of only 26 per cent. in acreage has resulted in an increase of 74 per cent. in yield.

These figures make it clear that the world's hope of a sufficient cotton supply in the future depends upon intensive cultivation, labor-saving machinery and the lavish use of fertilisers.

	Unfertilised States			Fertilised States
	Oklahoma	Other Older States	Total	
Acreage 1898-99 (acres)	531 000	13 281 000	13 812 000	11 155 000
Acreage 1911-12 (acres)	2 622 000	18 308 000	20 930 000	14 074 000
Crop 1898-99 (bales)	317 000	6 315 000	6 632 000	4 557 000
Crop 1911-12 (bales)	1 044 000	7 060 000	8 104 000	7 497 000
Increase acreage	394 %	38 %	51 %	26 %
Increase crop	230 %	12 %	22 %	74 %
Yield per acre 1898-99 . . . (bales)	0.60	0 48	0.48	0.41
Yield per acre 1911-12 . . . (bales)	0.40	0.39	0.39	0.56

1616 – Value of Electric Slag in Agriculture.

DE MOLINARI, M. and LIGOT, O. Valeur agricole des scories électriques. — *Annales de Gembloux*, Year 22, No. 10, pp. 567-570. Bruxelles, 1912.

For some years past electricity has been used in the manufacture of steel, but so far this process is costly and it does not appear likely to replace the older processes, such as Thomas', etc. But as the electric process also produces phosphoric slag and as it has already been demonstrated that by means of the electric process steel can be produced directly from the ore, it will be well to consider this by-product of the manufacture of steel.

Slags from electric steel works are generally poorer in phosphorus than Thomas' basic slag, because in the electric process only fine steels are obtained using common steel and cast iron as raw materials, neither of the latter containing much phosphorus. The quantity of slag produced per ton of steel is also rather low ; about one hundredweight. If the electric treatment of iron ore gains ground, electric slag may perhaps

sometimes be used for the adulteration of basic slag, and it is for this very reason that the writers have compared the manurial value of electric and basic slag. The slags used had the following chemical composition per cent.

	Soluble phosphoric acid			
	In mineral acids	In 2 % citric acid	Silica	Free lime
	—	—	—	—
Common slag	21.81	20.94	8 12	5 88
Electric slag A	5.12	1.56	8.76	4.06
„ „ B	6.76	1.38	8.58	4.58

The plants chosen for the experiment were oats grown in pots containing 4 kilos of sand manured with 2 grams of ammonium nitrate, 2 gr. magnesium sulphate, 1 gr. sodium sulphate, 1 gr. potassium carbonate and 1 gr. calcium carbonate besides the slag. The quantity of phosphoric acid was 0.20 gr. per pot. The results were the following:

Electric slag, considering only the total phosphoric acid, gave inferior results to those obtained by common slag.

Considering the citrate soluble phosphoric acid, B. slag yielded results similar to those of common slag, for this yielded an average of 14.8 gr. of seed per pot, while the average of slag B. was 15.4 gr. per pot.

1617 – **Variegation in Leaves.**

PRUNET, A. La Panachure des feuilles. — *Revue Agricole et Viticole de l'Afrique du Nord*, No. 31, pp. 729-730. Alger, October 12, 1912.

AGRICULTURAL BOTANY CHEMISTRY AND PHYSIOLOGY OF PLANTS

Plants with variegated leaves — trees, shrubs or grasses, are much used for ornamental purposes in gardens and parks. The variegation consists usually in spots or marbling of white or yellow, which occupy larger or smaller portions of the leaves and which are the results of the alteration or local disappearance of the chlorophyll, accompanied by modifications (sometimes of some importance) in the structure of the leaf.

It has been known for some time that certain variegations are transmissible by grafting (1) and the many researches recently made on this subject have led to the following results: Variegations, and total colorations, red, pink, or violet, such as are seen in *Coleus Achyranthus*, copper hazel and *Prunus Pissardi*, are not transmissible by grafting. White variegation is seldom transmissible, while yellow variegation generally is. The white variegation of the Samarie elm is, however, transmissible, while its yellow variegation is not. Yellow variegations which take the form of marbling or scattered patches are almost always transmissible;

(1) See No. 1512, *B.* Nov. 1912. (*Ed.*).

but those which are limited to the border of the leaf are only exceptionally transmitted.

The transmissiblity is reciprocal. Variegation can be transmitted by the grafting of a small fragment of variegated bark, without any buds, and also by an intermediate non-variegated individual. Thus, if *Abutilon arboreum*, a green variety, is grafted on *A. Thomsoni*, a yellow variegated variety, the former keeps its colour. If, however, upon the *A. arboreum* grafted on *A. Thomsoni*, another green variety such as *A. indicum* is grafted, the latter becomes variegated, as the variegation is transmitted through the *A. arboreum* although the latter remained green.

Variegations are generally transmitted progressively from the neighbourhood of the graft. They can, however, be transmitted to all the leaves, old as well as young, or only to the latter. They are generally, though not always, persistent. Individual immnunity exists, some plants belonging to a species normally susceptible to variegation, remaining under all conditions immune. Variegation is transmitted by means of the bark and the woody tissue alone : ringing prevents its transmission.

These curious facts have been regarded as furnishing strong arguments in favour of the reciprocal influence of scion and stock. But it seems more likely that the view of Baur and Lindenmuth is correct. They consider yellow variegation to be a disease of an infectious origin, in which case its transmission, being pathological, is easily understood. These two writers consider that the disease is usually due to a bacterium, which has escaped observation owing to its small size, like the bacteria of hydrophobia and of infectious peri-pneumonia, etc.

The infectious origin of variegation would explain its transmission, even in the absence of repeated grafting, or by means of grafting a fragment of variegated bark. The plants which transmit the variegation, while themselves remaining green, such as *Abutilon arboreum*, act like "carriers," who in times of epidemics of typhoid, cholera, etc., spread the disease without being themselves affected by it.

The objection has been raised against this theory of the pathological origin of variegation, that the bacterium, not having been seen, remains problematical, and that the injection of the sap of variegated leaves has no results. In any case, according to Lindenmuth and Baur, only yellow variegation is pathological.

1618 – The Effects of the Removal of the Male or Female Reproductive Organs, or Both, upon the Sugar Formation in the Stems of Maize and Sugar Sorghum.

HECKEL, EDOUARD. De l'influence de la castration mâle, femelle et totale sur la formation du sucre dans les tiges du Maïs et du Sorgho sucré.(1) — *Comptes Rendus hebdomadaires des Séances de l'Académie des Sciences*, Vol. 155, No. 16, pp. 686-690. Paris, October, 1912.

An American chemist, Mr. Stewart, has found that the removal of the female inflorescences of maize when the grain is milky causes a large sugar reserve to be formed in the plants thus treated and a diminution in the siliceous varnish of the stems. He thus obtained 9.1 % of saccharose from maize stalks, which led to the establishment of a new agricultural industry and allowed of the setting up of sugar-making factories in Pennsylvania and Cuba.

In 1911, the writer was able to verify the statements of Mr. Stewart by applying his method of treatment to a very large variety of maize (Servian Giant Maize) growing at Marseilles in the Botanic Gardens. Analysis showed that the stalks of this giant maize contained 2 cwt. of saccharose per ton. The year 1911 was very hot, which no doubt had some effect on the sugar production.

In 1912, the writer continued his experiments with certain modifications. Thinking that the removal of both the male and female inflorescences would cause an increased saccharose production, he treated some plants in this manner and compared the results with those obtained from normal stems, and from stems from which either the male or the female inflorescenses had been removed. The summer of 1912 was cold and thus the conditions were most unfavourable for the attainment of the object in view. Nevertheless, the comparison of the results obtained under identical conditions of soil and climate and with the same variety of maize, showed the influence exercised by these different mutilations on sugar formation.

The same observations, compared with the effect of complete removal of the male and female organs, were made on the sugar sorghum.

A first lot of maize thus treated was cut and the juice when extracted was analysed on the 10th of August of this year; the results per 100 cc. of juice were:

	Control (not mutilated)	Flowers removed		
		female	male	both
Maize cut August 10.				
Saccharose	4.08	3.97	3.61	8.14
Dextrose	1.28	1.24	1.37	1.38
Levulose	0.75	0.79	0.95	0.78

(1) See also: *B.* Dec. 1910, pp. 257-258; No. 2127, July 1911. (*Ed.*).

Other lots of stalks cut later gave the following results on analysis :

	Control (not mutilated)	Flowers removed		
		female	male	both
Maize cut August 16				
Saccharose	5 38	9 27	5.52	11.45
Levulose and dextrose . .	1.76	1 52	1.82	0.79
Maize cut August 30				
Saccharose	5.10	11 20	6 19	11.98
Levulose and dextrose . .	1 40	1.20	1 50	1.20
Maize cut September 19				
Saccharose	7 19	10 47	9.68	10.88
Levulose and dextrose . .	1.83	1 17	1.32	1 32
Maize cut October 9				
Saccharose	5.57	9 90	4 37	9 22
Levulose and dextrose . .	0 96	1.11	0 84	1.32

The same operation (complete removal of the inflorescence) was performed on sugar sorghum, of which the flowers are hermaphrodite; the following results were obtained per 100 cc. of juice :

	Control (not mutilated)	Inflorescence removed
Sorghum cut August 30.		
Saccharose	7.18	11.87
Levulose and dextrose . .	3.53	3 03
Sorghum cut September 28.		
Saccharose	10.94	13 70
Levulose and dextrose . .	3 53	4.46

	Sweet sorghum: Control (not mutilated)	Sweet sorghum: Inflorescence removed	Broom sorghum: not mutilated
Sorghum cut October 9.			
Saccharose	7.35	12.19	6.30
Levulose and dextrose . .	2.20	1.06	1.47

For the maize, the results of these different analyses are : 1) Complete removal of the reproductive organs certainly gives, from the point of view of the saccharose content, a better result than either of the two separate mutilations. 2) In those stems deprived of the male inflorescences there was a notable increase in the sugar content (in comparison with that of the control) from August, but it fell off somewhat in September. Thus, the effect of this operation is clearly shown, both in the case of the stems in which the male flowers alone were removed, and in that of those which

were deprived of both male and female flowers. 3) From September (there was a marked diminution in atmospheric heat this year) the richness in saccharose tended to disappear, and the yield became more equal in the case of all three methods of mutilation. 4) The amounts of glucose (levulose and dextrose) are less pronounced in plants from which the reproductive organs have been removed than in the control, but tend to increase from September where all the flowers were removed. 5) The highest saccharose content was found in stems cut on the 30th of August from which all the flowers had been removed.

The stems of sugar sorghum analysed on the 30th of August showed, in the case of those where the reproductive organs had been removed, an appreciable difference in saccharose content, and there is no doubt that this operation is thus a simple method of obtaining what has long been desired by growers — an increased saccharose content. This is a very important discovery, as the saccharose content of the control was only 10.94 per cent., while that of the mutilated plants reached 13.70 per cent. (crop of the end of September).

Unfortunately, both in maize and sorghum stems which have been thus mutilated, the juice contains a relatively large proportion of starch, especially in maize stems from which the female inflorescences, or both male and female inflorescences, have been removed ; there are only traces in stems deprived of their male flowers. The same effect was produced by similar operations on sorghum. This characteristic starch forms a large white deposit at the bottom of the vessels where the juice is put to settle. The starch grains are spherical and smaller than the normal grains of starch present in maize. In addition to starch, the same juices contain a small proportion of soluble matter, giving with iodine a dextrine reaction. The starch reserve in the mutilated plants, which have become richer in saccharose, in addition to diminishing the saccharose yield, is from the industrial point of view a source of great trouble, as it hinders defecation and crystallization. The writer hopes to make experiments, which he thinks will obviate this difficulty. He proposes leaving a single female inflorescence on each stalk (in complete mutilation), close to some plants which have been deprived of their female flowers only, and which will play the part of males towards the completely mutilated plants, and thus permit of the fecundation of the ears which have not been removed.

In the case of sugar sorghum, this consequence of complete removal of the reproductive organs can also be avoided by leaving some flowers in the inflorescence.

1619 - **Polymorphism in the Stamens of the Flowers of Fruit trees.**

Novikov, M. Novaia Pomologhiia. — *Selskoie Khosiaistvo i Liesovodstvo* (Agriculture and Forestry), Year LXXII, Part 8, pp. 470-481. St. Petersburg, August 1912.

The numerous and accurate researches of the writers have led to the demonstration of a fact which may be considered new in the annals of botany and very interesting both from the practical and the theoretical points of view. It is the existence, in the most widely spread varieties of fruit trees, of two types of stamens differing from each other in their development and in the periods in which their pollen ripens. Thus in the rosaceous stone-fruits the inner stamens, which are also the shortest, mature before the outer and longer ones, whilst in the rosaceous plants with soft pericarp and free seeds the contrary is the rule. There is no doubt that this arrangement has a decided influence on the process of pollination, which probably takes place as follows : When the dehiscence of the anthers of the outer stamens of a flower, for instance of a pear tree, takes place, the stigma is not yet in a condition to receive the pollen, which, conveyed by the wind or by insects, goes to fertilize other earlier flowers whose stigma is already mature. The pollen formed in the anthers of the central stamens, those with a shorter filament, fecundates the late flowers and sometimes the stigma of its own flower, if for some reason it had not yet been pollinated.

Polymorphism in flowers, on which only quite recently data have been collected, constitues a general rule for almond, apricot, peach, pear, plum, apple and cherry trees. The polymorphous elements are represented in these flowers by the different lengths of the stamens and pistils and by the resulting relative positions of stigmas and anthers. In this connection, however, it must be noted that sometimes even with a short pistil, the stigma may still be higher than the anthers when the stamens are situated at a distance towards the outside of the receptacle. With these researches interesting and practical problems are connected : thus, for instance, it may be inferred that the varieties with high stigmas are much exposed to cross-pollination and well adapted to thick planting. The existence of two types of flowers in peaches is important from both the theoretical and practical standpoints, expecially as an aid in distinguishing and classifying the very numerous sub-varieties.

The tendency to produce a number of petals above the average (sometimes, though more rarely, of sepals also), the presence of forms which mark a gradual passage from stamens to petals, etc., are conditions often observed in the flowers of fruit trees. In the Clara Mayer variety of peach the presence of an excessive number of petals may lead to complete sterility, but on the other hand the beauty of the flowers, of a fine light red, renders this variety valuable as an ornamental tree. In other cases this exuberant formation of petals diminishes but slightly the fruitfulness

of the plant, as for instance in the Reine Claude Mérolde variety. The writer proposes to study other interesting problems of correlation, such as that between the volume of the flowers and of the fruits, between the colour of the petals and of the fruits, all of them being characters of great importance in selection.

1620 – The Action of Sulphuric Acid on Seeds having Teguments with Malpighian Cells.

BIANCHI, C. L'azione dell'acido solforico sui semi a tegumenti con cellule malpighiane. — *Le Stazioni sperimentali agrarie italiane*, Vol. XLV, Part 6, pp. 681-715. Modena, 1912.

It is well known that the rapidity with which seeds germinate varies very considerably. Some seeds sprout within a few minutes of their being immersed in water, others only after a long or very long period. The slowness of germination is especially shown by Leguminosæ, Malvaceæ, Cistaceæ, Cannaceæ, Convolvulaceæ, Rhammaceæ, Sterculiaceæ and Tiliaceæ; that is, precisely in those families whose seeds are characterized by teguments of Malpighian cells (prismatic palisade cells with thick walls) and by lines, running parallel with the outside of the seed, which strongly refract the light. According to D'Ippolito (*Stazioni sperimentali agrarie italiane*, 1905) the difficulty of germination of the hard seeds of Leguminosæ is to be attributed to the special conformation of the rings round the canaliculi in the light-refracting line, which project into the lumina of the Malpighian canaliculi, obstructing them.

Many physical and chemical means have been tried with the object of facilitating the germination of hard seeds; the writer has added concentrated sulphuric acid to the list. The seeds were immersed for various lengths of time (mostly from half an hour to an hour and a half) in the acid, then repeatedly washed and placed in the germinators at the same time as the control seed, which had been steeped only in water. The results showed that concentrated sulphuric acid renders the tegument permeable to water and shortens the period of germination of seeds provided with Malpighian cells. These results confirm those obtained by Todaro with the seeds of Leguminosæ and corroborate D'Ippolito's and Gola's opinion, according to which the acid dissolves the substance of the rings round the canaliculi of the light-refracting line and dehydrates and disorganizes the Malpighian cells.

1621 – On the Selection of a Type of Wheat Resistant to Severe Winters. SELECTION.

KOLKUNOV, V. Niekotoriia Nabliudeniia Nad Povedeniem Rasletchnekh Sortov Osimoi Pscgnitzi v Tetchenie Simi. *Khosiaistvo* (*The Farm*), Year VII, No. 36, pp. 1161-1167. Kiev, September 13, 1912.

As is well known, the winter of 1910-11 was very unfavourable to winter wheats: at the Agricultural Experiment Station of the Government of Kharkov the varieties Red Turkey (from South Dakota), Banatka from

Kherson and other red wheats were completely destroyed. It was noticeable that awnless varieties bore the winter cold much better than those which are typically awned. But as the latter are the more drought resistant, the wheat selector in South Russia finds himself in a dilemma: Is it best to produce xerophytic varieties, which are very sensitive to frost, or to try to create varieties which, though cold-resistant, are only xerophytic to a slight degree? Let us for a moment consider this latter alternative.

During winter, the young plants may be destroyed by the direct action of low temperatures, or by the presence of a covering of ice or congealed snow which hinders the respiration process. It must be admitted in the first case, that if low temperatures have less effect upon plants possessing cells with a high osmotic pressure, the varieties which can withstand drought should prove more or less resistant to cold.

In the second case, on the contrary, xerophytic varieties would be more susceptible to the low temperatures of winter, for, allowing them to be endowed with greater transpiration energy, they are much more easily affected by want of oxygen.

The solution of the question, which varieties suffer least and which most, from the two above-mentioned causes, is one of great importance from the following reasons. A variety which is very liable to be affected by the winter cold, but is excellent from any other point of view, may be improved by crossing it with an inferior variety which is resistant to low temperatures. It is easily understood that before selecting the latter variety it is necessary to ascertain whether the type to be improved suffers from the action of low temperatures or from deposits of ice which hinder the transpiration processes.

What was the real factor which had so unfavourable an effect upon the young winter cereals during the winter 1910-1911? The majority of agriculturists attribute all the damage which occurred to the frosts. But, as a matter of fact, the varieties most injured were Banatka of Kherson and Red Turkey, which are well-known as highly frost resistant, while the Kostromka variety, which is very susceptible, was much less harmed.

The writer made two series of experiments in order to study separately the effect of low temperatures and that of a thick covering of snow or ice upon the various varieties of wheat.

1. *Effect of a covering of snow.* — Banatka α-xerophytic, and an indigenous non-xerophytic variety generally cultivated in the district of Kanev, were sown in alternate lines in four plots on the 19th of August. Before the winter set in, the plants in each line were carefully counted. When the first snow fell, the two centre lots were left with the natural snow covering, on the others was piled up a great mass of snow nearly 5 ft. high. The bad effects of this enormous quantity of snow on the two

first plots was very clearly to be seen. The proportion of dead plants was 33 per cent. in the case of the native variety, and 51 per cent. in that of Banatka α-xerophytic. The xerophytic varieties are thus the most susceptible to the effects of a thick and long-lying covering of ice or snow.

2. *Effect of low temperatures.* — Four different kinds of wheat were sown on the 26th of August in suitable zinc receptacles : 1) Squarehead ; 2) Podolskaia Banatka ; 3) α-xerophytic ; 4) Red beardless. There were 6 receptacles for each variety and 4 plants in each receptacle. At the beginning of winter, Squarehead had grown most, and the Red Bearless least. In measuring the length of the apertures of the stomata, the reason of this difference was apparent. The measurements were as follows:

	Length of apertures of stomata in μ.
Squarehead	77 8
Podolskaia Banatka	72 2
α-Xerophytic	68 0
Red Krasnokoloska	66 2

The plants were grown in a closed place and were only put out of doors on nights when frosts were expected. After having been exposed to low temperatures, the plants were gradually thawed in the laboratory in order to determine the injury caused by the frost. The type most resistant to low temperatures was Krasnokoloska and the least resistant was Squarehead, while Podolskaia Banatka, and α-xerophytic occupied an intermediate position. The observations showed that the part most affected by frost is the extremity of the leaf, which in the slightly resistant varieties turns yellow at once, even when the frosts are very slight.

The following facts are noticeable in the later development of the seedlings : normal growth for a certain time, then the gradual withering and falling of the leaves. The latter are replaced at once and this continues until finally the plant withers entirely. The withering occurs especially rapidly on bright sunny days. These occurrences admit of the following explanation : When the laminae have not yet fully developed, the amount of water lost through transpiration is immediately replaced by the water absorbed by the roots ; but when the leaves are entirely developed, the quantity of water lost is in excess of that absorbed by the root system and therefore, necessarily, some of the leaves wither. This withering suddenly diminishes the transpiration area, and renders possible, and even encourages, the formation of young leaves, and so the process goes on. As the same state of affairs continued also when the amount of moisture in the receptacles was kept constant, it must be admitted that the failure to absorb large quantities of water is due to alterations in the root-system. In fact, on examining plants with strong and luxur-

iant ærial portions, after severe frost, the writer found the greater part of the roots to be dead and thus incapable of functioning.

In considering the relation between the degree of xerophily and the influence of the frosts, it is seen that the xerophytic varieties are those which best resist low temperatures. Thus, the aim of the selector of wheat for Southern Russia is the creation of a variety which is at once xerophytic and frost resistant and at the same time able to stand for a long period a covering of snow or ice, which hinders the function of respiration.

CEREAL AND PULSE CROPS.

1622 – **New Varieties of Wheat** (1).

VIGIANI, D. A proposito di nuove varietà di grano. — *L'Agricoltura italiana*, Anno XXXVIII, Fasc. 731, pp. 609-611. Pisa, October 31, 1912.

At the Vegni Agricultural Institute during the year 1911-1912, which will be remembered for the extensive lodging of wheat in Italy due to the extraordinary weather, several varieties of wheat were tried with the object of ascertaining whether it would be advantageons to replace on a large scale the old varieties of wheat by new ones.

The writer confines himself to a report on the results of the cultivation on a field of about two acres, of four varieties of wheat, which he classifies according to the principal qualities required. They are Calbigia Rossa (Gentil Rosso), Stand-up Hybrid (Vilmorin's), Calbigia Rossa × Noé No. 56 (Passerini's hybrid) and Cologna Veneta × Sheriff (Boschetti).

As regards tillering the various wheats may be classified as follows: 1) Calbigia Rossa, 2) Calbigia × Noé, 3) Vilmorin's Stand-up hybrid, 4) Cologna × Sheriff.

According to development the order is; 1) Cologna × Sheriff, 2) Calbigia Rossa, 3) Vilmorin's Stand-up hybrid, 4) Calbigia × Noé.

According to rust resistance: 1) Vilmorin's Stand-up hybrid, 2) Calbigia Rossa, 3) Cologna × Sheriff, 4) Calbigia × Noé.

As for lodging, the year 1912 was a most severe test; whilst Calbigia Rossa showed but mediocre resistance, Passerini's and Vilmorin's (2) hybrids gave excellent results; the order according to resistance to lodging is: 1) Calbigia × Noé (Passerini's hybrid), 2) Vilmorin's Stand-up hybrid, 3) Calbigia Rossa, 4) Cologna × Sheriff.

Classifying according to earliness of ripening, the first place belongs to Cologna × Sheriff and the last to Vilmorin's hybrid.

The yield in grain per acre was as follows:

1. Calbigia × Noé	34.5	bushels
2 Vilmorin's Stand-up hybrid	32 3	,,
3. Calbigia Rossa	30.0	,,
4. Cologna × Sheriff	27.8	,,

(1) See No. 1411, *B.* Oct. 1912. (*Ed*).
(2) See No. 1518, *B.* Nov. 1912. (*Ed*).

1623 – Pearl Millet in the Kasai District, Belgian Congo.

L. P. Le Millet à Chandelle dans la région du Kasai. — *Bulletin Agricole du Congo Belge*, Vol. III, No. 3, pp. 666-668. Bruxelles, September 1912.

Mr. P. Lecke showed in 1907, that Pearl Millet (*Pennisetum americanum* L. K. Schum), also known under the name of *P. typhoideum* Richard, comes from several wild species of *Pennisetum* and notably from *P. Gynucothrix* (A. Br.) K. Sch., *P. Perrottetti* (Klotsch.) K. Sch., *P. mollissimum* Hochst, *P. violaceum* (Lam.) Rich. and *P. versicolor* Schrad., all African species. On account of the wide-spread occurrence of this cereal in Africa and the restricted area of its cultivation elsewhere, it is supposed that pearl millet was first grown in Africa, and in particular in the tropical region, and made its appearance much later in North Africa. This cereal, which is the staple food of the inhabitants of the steppe, grows 3 to 10 ft. high and its stalk is terminated by a spike 4 in. long bearing small brown seeds. In the countries where this cereal is habitually cultivated, it goes through its different vegetative phases in from 3 to 5 months (1). It merits cultivation, as its seeds are rich in nutritive substances ; this is shown by the following table :

Water	11.3
Albuminoid substances	10.4
Fatty matters	4.0
Starch	71.3
Crude cellulose	1 0
Ash	2.0

According to Col. Descamps, pearl millet is the least cultivated of all cereals, in the Kasai district, being only found on the neighbourhood of Luluabourg, where it is also used in the manufacture of beer. In this district, the ear never exceeds 4 to 6 in. in length nor the plant about 3 ft. in height. The crop is not always good, as the grains are often attacked by a fungus, which turns them completely black. Like maize, this millet is sown in the rainy season. In other districts of the Congo, the plant is much cultivated by the natives, as in the southern portion of the Kasai district as well as in the neighbourhood of Lusambo, where M. E. Laurent saw a perennial form. In the south-west of the Congo, this cereal is even more intensively cultivated than sorghum. According to Baum's observations, it ripens 4 months after sowing ; the ears are then cut and the stems

(1) It is an annual plant resembling Sorghum in appearance, but it is shorter and is clearly distinguished by its inflorescence, which consists of a cylindrical, erect, terminal spike 6 to 8 in. long and $^3/_4$ to 1 $^1/_4$ in. wide, somewhat resembling that of a bulrush (*Typha*), which explains its French name " Candle Millet " and the name *P. typhoideum*.

Cf. G. Capus and D. Bois : *Les Produits Coloniaux*, pp. 67-68. Paris, 1912. (*Ed.*).

are used for feeding cattle. The plant yields a crop for three years and at the end of this time, is resown. The Sub-Director of Agriculture, M. Mestdagh, states that pearl millet is much grown along the Lusambo-Katako-Kombe route, whole fields of it being met with. The natives make a flour of this millet, which the Europeans use mixed with wheat flour.

FORAGE CROPS
MEADOWS
AND PASTURES

1624 - **The Introduction of Lucerne into the Colonies.**

GUYOT, HANS. Die Luzerne und ihre Einführung in den Kolonien. — *DerPflanzer*, Year VIII, No. 8, pp. 431-433 Daressalam, August 1912.

Many colonists commit the grave error of conducting experiments on the introduction of useful European plants into the colonies, without considering the fact that the seeds of a plant, in spite of the most scrupulous care, in the greatest number of cases do not sprout so well and do not give origin to such vigorous plants as they do in the country in which they have been for a long time acclimatized. And yet very frequently it would be easy to obtain the desired seed from localities which from their geographical position and climate most resemble the country into which the plant is to be introduced. Many unsuccessful attempts are due to the neglect of this precaution. As an instance the writer mentions an experience of his. In 1910 he had some lucerne seed sent to him from Europe. The seed was excellent. It was sown in January and at first succeeded very well; but in March, when the hot winds from the desert began to blow, the lucerne ceased growing and, notwithstanding irrigation and the care bestowed upon it, its development was arrested and the plants barely attained 10 or 12 inches in height. The writer then obtained some lucerne seed from Asia Minor with which in half the time required by the European lucerne he obtained a very fine field of lucerne in bloom, 28 inches in length. The same results attended a control experiment carried out in a perfectly uniform field, one half of which was sown with European and the other with Asiatic lucerne. Six months after sowing, the former plants were only 10 inches high while the others were 28. The reverse was the case in an experiment conducted in Europe with the same seeds.

The explanation is obvious. Lucerne, that the Arabs to this day call " bersim hagasi " or Hagas-Hedjas clover, is of Arab origin, but has long been introduced and acclimatized in many other countries, in each of which it has undergone changes, adapting itself to the new surroundings: this, of course, during a long series of generations. It is therefore impossible that good results can be obtained from the first generation after importation into the African colonies of seeds coming from, say, the North of Germany. On the contrary, seeds must be procured from nearer localities situated in similar conditions: in the case of lucerne, from Egypt (where this forage plant is cultivated, though not to a great extent and consequently the seed is dear) or from Asia Minor.

1625 – On the Presence of Hydrocyanic Acid in White Clover.

MIRANDE, MARCEL. Sur la présence de l'acide cyanhydrique dans le Trèfle rampant. — *Comptes rendus des Séances de l'Académie des Sciences*, Vol. 155, No. 15, pp. 651-653. Paris, October 7, 1912.

The writer has observed in white or Dutch clover (*Trifolium repens* L.) a substance which, under the influence of an enzyme acting after the manner of emulsin (also present in clover) decomposes, giving rise to hydrocyanic acid and other products. Plants under the influence of anæsthetics (chloroform, ether, etc. (1)) give off hydrocyanic acid, after the death of the cells due to plasmolysis, which is brought about by the contact of the cyanic substance with the hydrolysing enzyme.

The researches of the writers have been entirely confined to wild white clover. The method of estimating the amount of hydrocyanic acid was that usually employed for this purpose.

In the organs of a plant which was analysed on the 6th of August there were the following amounts of hydrocyanic acid in grams per 100 parts of the organ in question:

Leaflets	0.0102
Petioles	0.0025
Stalks	0.0010

No hydrocyanic acid was found in roots analysed on the 20th of September.

The analysis of twelve lots of clover leaflets from different parts of France gave an average of 0.0149 gr. of hydrocyanic acid per 100 gr. of substance; the amount of hydrocyanic acid varied between 0.0391 gr. and 0.0036 gr. per 100 gr. of substance.

The writer draws attention to the fact that the hydrocyanic acid content of white clover varies much according to the nature of the soil, the vegetative period and the sample taken. Clover gathered in a meadow would have quite a different hydrocyanic acid content from that of clover growing close by on the bank of the road skirting this field.

Trifolium repens must thus be added to the list of Leguminosæ-Papilionaceæ which contain hydrocyanic acid. This includes two species of *Lotus*, the well-known *Phaseolus lunatus* and *Ph. Mungo*, several species of *Vicia*, one of *Dolichos*, *Cicer arietinum* and *Indigofera galegoides*.

(1) *Comptes rendus de l'Acad. des Sciences*, July 12, 1909.

FIBRE CROPS. 1626 - **Report to the Minister of Agriculture on Experiments on the Retting of Flax by the Bacteriological Process presented by M. Emile Feuillette. Summary of Observations made at the Machine Trial Station in Paris.**

RINGELMANN, M. Rapport au Ministre de l'Agriculture sur les essais de rouissage du Lin, par le procédé bactériologique présenté par M. Emile Feuillette. Résumé des constatations faites à la Station d'essais de machines. *Ministère de l'Agriculture, Direction de l'Agriculture, Bulletin mensuel de l'Office de Renseignements agricoles.* Year XI, No. 9, pp. 1175-1182. Paris, September 1912.

This is a report, presented by the director of the Paris Machine Trial Station, of the Commission appointed to examine the bacteriological method of retting flax, invented by M. Emile Feuillette.

The chief characteristic of the method is that it can be applied at any season of the year. It was therefore interesting to set during the coldest weather in winter. In order to ensure conditions more unfavourable than those prevailing on industrial premises, the frames and drying plant were only protected by a shed ; the retting tank was under a shed enclosed by palings. Nevertheless the unfavourable experimental conditions had no influence on the result, showing that retting may be carried on with great regularity throughout the whole year, which is a great economical advantage for establishing cooperative works.

In the following table the results of several experiments are summarized, all the figures being referred to 100 lb. of threshed flax tied in bundles and corresponding to 121.7 lb. of unworked flax.

The raw flax used in these experiments was grown in the department of Seine Inférieure ; it was of common middling quality. The retting liquid was still serviceable after 12 days. As the retting proceeded very regularly it was possible to fix 24 hours beforehand when the flax would be sufficiently retted to be taken out of the pit. The lint turned out very resistant.

In good years 100 lb. of good flax yield, after retting in the running water of the Lys and drying, 25 lb. of lint ; but in bad years such as 1912 not more than 15 or 18 lb. can be reckoned upon. The 18 lb. of lint obtained from 100 lb. of retted and dried flax correspond to 12.04 lb. obtained from 100 lb. of rippled flax tied in bundles and ready for retting. With the new method now experimented 13.63 lb. of good lint were obtained from 100 lb. of common flax in bundles.

In a hackling experiment the yield was 52 per cent., and the loss 8 per cent. (rather too high, probably due to having carried too far the removal of the gum from the fibre). In another experiment the following percentages were obtained.

Hackled flax.	54.38
Tow	33.33
Tailings	8.42
Loss	3.86

Number of Bundle	FLAX						PRODUCE		
	in bundles before retting	Taken out from retting pit	after draining	after drying	after second drying	after scutching	Lint after hackling	Fine tow	Coarse tow
	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.
1	100	364.60	323.50	72.22	63.07	27.91	13.28	2.86	6.15
2	100	356.16	308.22	78 34	66.80	32.35	12.65	4.96	5.85
3	100	361.82	309.21	77.45	69.65	35.00	13.93	5.16	6.44
4	100	347.05	313.38	76.96	68.28	35.43	14.35	3.63	6.64
5	100	356.10	302.93	75.27	66.75	40.58	13.98	2.45	6 47
6	100	337.19	291.50	79 39	—	—	—	—	—
7	100	320.69	284 33	78.49	—	—	—	—	—
8	100	313.11	281.42	71 62	—	—	—	—	—
Average of bundles 1 to 5	100	35714	311.44	76.04	66.91	34.25	13.63	3 81	6 31

The spinning was successful. The thread was examined by the office for the conditioning of textiles at Lille and pronounced to be of the best.

The report concludes by declaring the process which has been examined to be excellent and at the same time very simple. The quantity of residual water is sufficiently small to allow of its being used for irrigating limited areas or of being purified by bare soil, instead of running it into water courses, the pollution of which is thus avoided.

1627 - A Note on Two Textile Plants from the Belgian Congo.

Note sur deux plantes textiles du Congo Belge. — *Bulletin Agricole du Congo Belge*, Vol. III, No. 3, pp. 619-620. Bruxelles, September 1912.

The following are some data collected by M. Mestdagh, the Sub-Director of Agriculture in the Congo, on two textile plants called by the natives " akonge " and " losa ," or " n'kosa," of which botanical specimens have been sent to the Brussels Botanical Gardens for determination.

" Akonge " (*Triumfetta semitriloba* Jacq.), which is found usually in cleared forests, is from 3 ft. to 10 ft. in height ; 11 kg. of stems have yielded 2.35 kg. of bark, giving 0.70 kg. of dry fibre. The plant grows amongst clumps of another textile plant, *Cephaloneura polyandrum* K. Schum,

also belonging to the Tiliaceæ, which is called by the natives of certain districts "bekonge" or "bokonge."

In the preparation of "akonge" fibre, the stem is split through the centre, the bark is stripped off and the fibre is beaten with a club on a log till all the soft part is removed. In order to make the fibres into rope, the native unrolls and twists them on his thigh, using his hands for the purpose.

"Losa," or "n'kosa," (*Manniophyton africanum*) is a liana with fibrous bark; it attains a length of from 30 to 80 feet and is met with in all the forests. 20 kg. of green stems have yielded 2 kg. of bark, giving 350 gr. of dry fibre. The liana is cut in pieces of 2 to 2½ ft. in length; the fibres are short and tear obliquely; they are scraped with a knife to free them from all pectic matter and are placed in the sun to dry. These fibres are used for making ropes and hunting and fishing nets; they are stronger and more durable than those of the "akonge."

SUGAR CROPS.

1628 - **Flowering of Sugar Cane in Bengal.**

WOODHOUSE, E J. in *Department of Agriculture, Bengal, Quarterly Journal*, Vol. V, No. 4, p. 179. Calcutta, 1912.

The sugarcane season 1911-1912 has been remarkable in Bengal for the large number of cane varieties which have flowered. The following have been reported: — Benaresia and Boraukha varieties flowering in Patna; Chynia in Sabour and in Patna; Kantari in Cuttack; Khari in Sabour, Chinsurah, Patna and Cuttack; Khelia or Khelai in Sabour and in Nadia; Maneria in Sabour; Nata in Nadia; Pansahi in Sabour; Paunda in Patna; Shakar Chynia in Sabour. The writer was able to examine the flowers of the varieties growing at Sabour, and in only one case did he find that the anthers opened and shed their pollen. In the case of Khelia he found that in a few flowers the tops of one or two anthers had opened and some pollen grains had been shed onto the stigmas. This is the only one of the above varieties which has been reported to produce seedlings in Bengal. In the case of all the other varieties the anthers were pale yellow in colour, but none were ever observed to have opened or to have fully formed pollen grains.

OIL CROPS.

1629 - **The "Utelo", a Plant with Oleaginous Seeds.**

L'Utelo, plante à graines oléagineuses. — *Bulletin Agricole du Congo Belge*, Vol. III, No. 3, pp. 645-646. Bruxelles, September 1912.

M. Mestdagh, Sub-Director of Agriculture in the Belgian Congo, furnishes the following statements regarding a plant with oleaginous seeds called "utelo" by the natives, and of which the scientific determination has not yet been made in Europe. The "utelo" belongs to the Cucurbitaceæ; it has a branched and creeping stem attaining sometimes 16 ft.

in length ; it grows very rapidly and soon covers the ground. The fruits, which are spherical, ripen three months from sowing the seed. The natives maintain that fruits from plants grown on forest soil are much larger than those borne by plants growing in the village of Méanga on the sandy soil of the plain. The seeds are removed from the fruits and dried in the sun ; they are piled up and watered with boiling water in order to remove the cortex. For the extraction of the oil, the seeds are reduced to a paste by pounding them in a mortar, and are then thrown into boiling water and constantly stirred. As soon as the oil appears on the surface of the water the pot is withdrawn from the fire and left to stand. The oil, which is separated by decanting, is used in the preparation of food.

1630 – **The Propagation of Hevea from Stumps.**

RUBBER, GUM AND RESIN PLANTS

L. P. Stumps d'Hevea. — *Bulletin Agricole du Congo Belge*, Vol. III, No. 3, pp. 559-562. Bruxelles, September 1912.

The greater part of the Hevea plantations in Malacca have been established by the help of stumps. The latter are considered as advantageous, for they permit of the young stem being placed at the required height and ensure the existence of individuals with a straight and healthy taproot. The stumps have the disadvantage of requiring some time before beginning to bear leaves, but on the other hand the new stem develops more rapidly than when it belongs to an ordinary young plant and the lost time is thus regained.

Information recently furnished by the agriculturists of the Belgian Congo seems to show that the adoption of the stump method of reproduction would give good results, if the stumps were grown and prepared in the plantation station. If, however, they are sent from the seed station, and if the latter is very far off, their recovery leaves much to be desired. This explains why the stumps sent have not always been successful. It would certainly be possible to increase the chances of their recovery by improving the methods of packing, *i. e.* they might be placed in cases kept moist and be given more shade and water after replanting.

The following is a description of stump propagation : the seeds are planted in nurseries at intervals of 8 in. either way and just covered with earth ; the seedlings are left in the nursery until they are about a finger thick at the base. At the time of replanting, the plants are uprooted, care being taken to preserve as much possible of the taproot. They are subsequently pruned in such a manner that the lateral roots and branches are cut off clean at about half an inch from the taproot and the stem. The taproot is cut just above where it loses its stiffness and begins to bend ; it is about the size of a thin pencil. The stem is cut at 30 to 40 inches above the collar. The stumps thus obtained are made up in bundles of from 20 to 25, covered with wet moss and a cloth and dispatched. They

stand a journey lasting 10 to 15 days, provided they are kept moist. The stumps are planted in the rainy season in holes 24 × 24 × 24 inches, the collar being placed a little above the level of the surrounding soil and the earth from the hole being piled up round the base of the stem.

VARIOUS CROPS

1631 – **Tobacco Cultivation in Sumatra.**

AMBRYN. Note sur la culture du Tabac à Sumatra. — *Bulletin Agricole du Congo Belge*, Vol. III, No. 3, pp. 589-618. Bruxelles, September 1912.

The writer, on his return from an expedition for studying agriculture in the Dutch East Indies, gives the following information respecting the cultivation of tobacco at Deli (1).

Organization of the plantations. — The large tobacco plantations in Sumatra are usually divided and managed by different sub-directors controlled by one director. A division consists of 3 or 4 sub-divisions, each containing 90 fields. A tobacco field generally covers an area of 1.85 acre, that is to say a "bouw," and a sub-division, including buildings and roads, represents about 173 acres of tobacco. As the rotation is usually an eight year one, the area of a sub-division should be 1380 acres; a division covers an area of 4150 to 5535 acres. This also includes some acres of forest and pasture land.

Climate. — The average temperature at Deli is 28° C., and during the time chosen for the cultivation of tobacco, the thermometer does not fall at night below 22°C. The average annual rainfall is from 100 to 120 inches.

Soil. — The soil of the district of Deli is a marly clay or silt; the marl is rich in humus and the depth of the arable stratum is very variable. A loam soil rich in humus is the best for tobacco-growing.

Labour. — It is calculated that 2 or 3 labourers are required per "bouw" (1.85 acre). As a rule, Chinese are employed; these do the work of the nurseries, planting out, interculture, hoeing and gathering the crop. The clearing, first breaking up of the land, building, drainage, etc., is the work of Javans, for the Malays (natives of Sumatra) are unsuitable for skilled work.

In order to promote the immigration of coolies, the planters have established a special bureau, and the Government has appointed a Service for the purpose of enforcing the rules regarding the rights of immigrants. Each coolie is entrusted with the care of a field containing 16 000 tobacco plants, which he plants out, tends and harvests. He receives from 8½ to 11½ florins (14s. to 19s.) for every thousand plants. The work of drying and sorting the tobacco, etc., is paid separately, and by piece. An account is opened in his name, in which he is debited with the amount advanced

(1) See No. 2133, *B.* July 1911. (*Ed.*).

for his journey, tools, the wages he pays himself to other labourers for work done on the fields of the division entrusted to him, and finally, for an advance of 1 ½ to 3 florins (2*s.* 6*d.* to 5*s.*) and for rice, which he receives every fortnight.

The medical service, which is often at the expense of the estate, is regulated according to the measures prescribed by the Government.

Preparation of the soil. — About 6 months before the making of the nurseries, the soil of the future plantation has to be prepared. After marking out the roads and the position of the drainage pipes, the forest is cleared and hoed to a depth of 10 or 12 inches. At Deli, the plantations are made on savannahs, which have been broken up by the hoe almost exclusively and ploughed to a depth of 14 or 18 inches. The first ploughing is done 6 or 8 months before planting; three ploughings are made, the last shortly before the seedlings are planted out. These ploughings must never bring up the subsoil.

Nurseries. — Usually, the nurseries are prepared during the driest months, *i. e.* from the middle of January to the middle of March. The seedlings remain 40 to 50 days in the nursery. From the middle of March to the middle of May the rainfall increases in frequence and intensity, and this is the time chosen for planting out. The months of June and July, being drier than the preceding ones, are favourable to growth, ripening and harvest. The vegetative periods lasts from 60 to 90 day.

The nurseries are placed in the middle of the sub-divisions, in order to facilitate their superintendence. They are made, by preference, on a recently cleared portion of virgin forest. The soil is broken up with the hoe to a depth of 16 to 20 in. and the surface is divided into strips of 20 ft. by 3 ft., divided by paths 5 ft. 6 in. broad furnished with a small central drainage-ditch. The nurseries run north and south, and artificial shelters are made of rice straw inclined in a west-east direction, which protect the young plants from heavy rain, while at the same time they offer no obstacle to the rays of the morning and evening sun. The nursery should be prepared shortly before sowing, in order that the soil shall be sufficiently friable to ensure the seedlings taking root. Before sowing, the nursery is watered and manured; the different beds are sown in succession, so as to allow for the time taken in planting out later on. The labourer, when sowing, mixes tobacco ash with the seed, in order to keep off insects, or else he puts the tobacco seeds in a watering-can full of water and thus sows and waters the nursery at the same time. The best time for sowing is the evening, and the weather should be dry; 1 to 1.5 gr. of seed is used for each bed; too close sowing is avoided. When the seeds have germinated, the seedlings are thinned out so as to leave from 800 to 1000 plants in each bed. Every evening and morning, the shelters are removed for some hours, so that the young plants may be quickly accustomed to the

direct action of the sun's rays. As a rule, they are sprayed on the 15th day with Bordeaux mixture, and from the 20th to the 25th day the shelters are removed for good. Afterwards, in order to protect the seedlings from insects, on the removal of the shelters, a very transparent white cloth, supported by a frame, is put over the beds ; the cloth is removed for some hours after rain and during watering.

Planting out. — The seedlings are planted out after the first rains in fields of about 20 yards by 275 yards and preferably run north and south. The operation is carried out very rapidly, to ensure the tobacco developing under similar conditions and being homogeneous ; as a rule, planting out takes a month and a half, but sometimes it lasts three months. The plants are set 18 inches apart and 3 ft. between the rows.

Manures. — These are applied on the day of planting; the chemical fertilizers are mixed previously in different proportions, of which three are the following :

	I	II	III
Ammoniacal nitrogen	3	0	5
Phosphoric acid	10	10	10
Potash	5	10	5

This mixture is given at the rate of 21 oz.per 100 plants and is either applied dry, some being placed in each hole and mixed with the watered earth which is to fill it in, or else it is dissolved in water, 1 ounce of fertilizer being used to the gallon of water ; each hole is then given 1 $^3/_4$ pints before the plants are put in. The latter method gives the better results.

Care of the growing crop. — When all the seedlings are planted out, they are watered every day except in the case of a heavy rainfall ; after a week, if they have taken root well, they are earthed up ; this process is repeated on the plants reaching a height of 20 inches, and the buds which have formed in the axils of the leaves, together with the broken leaves, or those covered with earth, growing at the base of the plants are removed, and the weeds and vegetable parasites are destroyed ; sometimes the plants are earthed up a third time. When the inflorescences form, the tops are removed, but the axillary buds which grow after this operation are as a rule left.

Seed plants. — In each subdivision 60 or 80 of the most vigorous and best developed plants are selected ; the tops of these are not removed and they furnish the seed for the next year.

Preparation of the leaves. — The plants reach maturity 60 to 80 days after being planted out, and the crop should be gathered at once, when the plants are ripe. In order that no immature leaves may be gathered, the leaves are removed at Deli one by one ; four different kinds of leaves are distinguished on tobacco plants :

4 to 6 sandy leaves (savonnettes)
6 from bottom of stem
6 „ centre „ „
4 to 6 „ top „ „

The labourer begins by removing all the leaves of the first category and then proceeds to cut off the others in succession. The leaves are gathered very early in the morning and are removed from the field to the shed on a hand-barrow, or in special baskets; they are then placed on mats, where they become soft and pliable. The leaves are made up into wreaths and suspended in the barn; they are then dried and tied into small bundles, and subsequently are despatched to a fermentation shed and are afterwards sorted, made up into small bundles, and packed. Between the crops, when the harvest is over, the stems are rooted up and the fields made over to the natives for growing rice or planting with teak or *Crotolaria*, or else brushwood is allowed to invade the ground.

In Sumatra, the cost price of a pound of tobacco sent to the European markets is estimated at from 0.80 to 1 florin (1*s.* 4*d.* to 1*s.* 8*d.*). A coolie can clear from 30 to 36 rods of savannah a day, and can dig from 24 to 30 rods to a depth of 18 inches. He can gather and hang up from 32 000 to 40 000 leaves a day.

Pests. — Worms, insects, fungi and bacterial diseases all attack the tobacco plant and have to be kept in check by means of petroleum emulsions, Schweinfurth green, Bordeaux mixture and chloride of lime. There is, however, no remedy for *Phytophthora Nicotianae*. This fungus causes a rot like the potato disease (*Phytophthora infestans*). Damp is favourable to its development, and on its first appearance all the infected plants must be uprooted and burnt, the whole bed must be destroyed, and the soil disinfected and worked with implements sterilized by fire.

1632 – Tobacco in Madagascar.

Le Tabac à Madagascar (D'après un rapport officiel adressé à la Commission permanente des tabacs coloniaux). — *L'Agriculture Pratique des pays chauds*, Year 12, No. 114, pp. 192-202. Paris, September 1912.

In Madagascar, tobacco is cultivated only by the natives. This industry is much developed in the district of Ambatolampy, which alone produces annually 837 000 lbs. of leaves gathered from an area of 620 acres and representing a value of 200 000 fr. (about £ 8 000). Next follow the sector of Maevatanana with 180 000 lbs., the Manyakandriana district with 165 000 lbs., the Ambatondrazaka district with 44 000 lbs., the Province of Vohémar with 24 000 lbs., and lastly the districts of Antsirabe and Betafo with 22 000 lbs. and 1 100 lbs. respectively. The local production can be estimated at 800 tons, and it is entirely consumed by the native population, none being left for export.

The importation, which is solely for the benefit of the small European colony, amounts to about 16 000 lbs., of which 5 070 lbs. come from Réunion and 385 lbs. from Durban and Egypt, while the rest is sent from France and Algeria.

Some experiments have been made by Europeans of introducing foreign varieties with a view to improving the production; these, however, have proved unsuccessful, as it was impossible to compete with the native production. Only native varieties are cultivated, but it is difficult to find one's way in the maze of names given to the different varieties grown in Madagascar. No selection has ever been carried out and the crosses are without number. One of the varieties mentioned, called "Jilo," which has short, pointed leaves, appears very widely grown; it has two sub-varieties which are distinguished according to the greater or less width of the leaves.

Soils, tillage, manures. — Tobacco requires in Madagascar a light, rather damp loamy soil, which must be rich in natural or supplied humus. Preliminary clearing, followed or not by the burning of the weeds, usually precedes tillage, which is accomplished with an "engady" (spade) to a depth of 12 to 28 inches according to the district. Usually a manure is dug in with the ashes at the first digging. In the Ambatondrazaka district, the native is careful to pen live stock on the ground eventually destined for tobacco cultivation. The ploughed soil is levelled, holes often being made first, to facilitate planting. There is no proper irrigation of the planted soil; the native contents himself with watering his field by hand, should the weather remain fine for many days. No chemical fertilisers are used; sheep manure is employed by preference, and is applied often in two or three dressings: during digging, in the holes made for the plants, and also during the growing period. In the province of Fianarantsoa, the native gives his tobacco, at the time of the first digging, very decomposed manure and even ashes; he adds more during the course of growth. It should be noticed that potash salts are added by the digging in of the plants which are burnt off, not with the intention of enriching the soil, but to facilitate the digging.

Sowing and cultivation. — The time of sowing is rarely stated; but it seems clear that the whole course of vegetation must be completed during the rainy season (November to April for the Central Plateau) and during the dampest season in the coast districts. Sowing is done broadcast; the Malagasy seem to have adopted the principle of nurseries for the final planting. The plants are planted out on reaching a height of 2½ to 4 inches; they have at this time two or three leaves. The distance left between two plants varies according to the district from 12 in. to 32 or 39 in. The planting is done always in holes of 8 to 12 in. diameter and usually half filled with manure and soil.

Generally, the native tops the plants on their reaching a height of 24 or 28 in., sometimes, when they are over 3 ft. high; at this time they have 15 to 20 leaves, not including the lower ones, which are early removed. The number of leaves left varies according to the districts from 12 to 15, sometimes reaching 20. Nearly everywhere the side shoots are carefully pinched off; this is more the result of observation than of systematic instruction. Besides tending the nursery, the native usually gives sufficient attention to the adult plantation; it is watered in seasons of drought, and also hoed and weeded frequently. A daily practice is hunting for white grubs, which attack the tobacco stem and destroy the roots. In some districts, an insect ("tetiravina" at Analava and "olipanjehy" at Fort-Dauphin) devours the leaves. Even in the most productive districts, the tobacco is grown on the same soil for two or three consecutive years, after which follows a fallow period. Where the tobacco crop is annually followed by another, there is no rule as regards the rotation to be observed.

Harvest and preparation of the tobacco. — With few exceptions, the tobacco plants on reaching maturity are cut to the level of the soil and then dried, with or without the leaves attached. The leaves, removed with a knife and cut off with a fragment or stump of stem adhering, which enables them to be easily threaded on a string, are then dried for some hours in the sun before being placed to desiccate. The drying, which, owing to the pressure the leaves undergo, is often confused with fermentation, is practised even in the case of the native-grown product. In some districts, the fermentation alternates with the drying, and these two operations are repeated twice or thrice. The operation lasts from 2 to 4 or 5 days.

The most usual form in which the tobacco is prepared is in leaves, the blades being flattened and the leaves tied up in packets containing 20 to 25. In some districts, the veins are removed and the leaves are rolled into twists with a diameter of 8 in. and a length of 20 in. The tobacco transported to the interior of the colony is all in this form. For retail sale, the tobacco is also often offered in the form of a fine powder mixed with the ash of other plants varying according to the taste and district; the proportion of ash being as a rule one third. The use of tobacco powder mixed with ash for chewing purposes is very widely spread, and is the only one existing among the natives; it is chewed by most of the Malagasy of both sexes. The natives very rarely smoke, but two-thirds of the Baras of the province of Tulear are addicted to this habit. Tobacco is hardly used at all as snuff, or for other uses.

As a rule, the price of tobacco in leaf varies to as much again, according to whether the buyer obtains it from the producer or buys it in the

market; further, prices vary enormously from one district to another. A list is given of the market prices, not including the transport expenses, which are defrayed by the purchaser.

1633 – Production of Tea in India in 1911.

NOEL-PATON, FREDERICK: *Note on the Production of Tea in India in* 1911. Brochure, 17 pp. Calcutta, 1912.

The writer gives in Appendix I, which accompanies his note, the areas occupied by tea every year since 1885. The following table shows the extent of the plantations in the years 1910 and 1911:

	1910	1911
	acres	acres
East Bengal and Assam	442 582	449 544
Bengal	53 530	53 737
North India (United Provinces and Punjab)	17 281	16 993
South India (Madras, Travancore)	48 466	52 601
Burma	1 695	1 700
Total	563 554	574 575

Of the whole area, 534 621 acres were harvested in 1911; the rest was not, for several reasons, one of which being that the plants were too young to be plucked. The total number of plantations was 4414 in 1911 as against 4402 in 1910. The average area of the 954 plantations in E. Bengal and Assam was 471 acres; that of the 178 Bengal plantations was 302 acres, while the 79 plantations of Travancore averaged 405 acres. The average in Madras is much lower than it is in the United Provinces and Punjab, these figures being respectively 142, 129 and 3 acres.

Production. — The annual tea production since 1885 is given in Appendix I; and it is noticeable that since this date the whole area of the plantations has increased 102 per cent., while the crop has increased 276 per cent.

The total crops of 1910 and 1911, estimated at 263 358 598 lbs. and 268 526 197 lbs. respectively, is divided among the different districts of India as follows:

	Assam lbs	E. Bengal lbs	Bengal lbs	N. India lbs	S. India lbs
1910 . .	175 095 069	50 418 777	14 412 287	3 464 129	19 963 336
1911 . .	179 053 017	50 403 308	14 536 057	4 023 871	20 509 944

The Burma production is not included in these figures, as it is nearly all converted into a condiment called "letpet." The average production per acre in the whole of India (excluding Burma) was 503.9 lbs. in 1911 as compared with 405.8 lbs. in 1910.

The writer gives the variations in area and production from 1885 to 1911, and then deals exhaustively with the question of export.

The Consumption of Tea in India. — The following table gives the balance of green and black tea available for consumption:

	Production (1) lbs	Net exports lbs	Balance lbs
1907-08	244 668 973	223 201 905	21 467 068
1908-09	247 364 750	228 763 984	18 600 766
1909-10	258 317 942	244 659 111	13 658 831
1910-11	263 605 240	249 044 545	14 560 695
1911-12	268 823 436	253 307 884	15 515 552

The writer next gives a detailed comparative summary of the prices paid in Calcutta for the different grades of tea and in London for the three chief kinds, "Broken Pekoe," "Pekoe" and "Pekoe Souchong," and concludes with an account of the commercial situation, the capital employed in the Indian tea industry, the freight, and the duties levied on tea in the different countries.

Two appendices are added, one giving a statement of the production of tea in India from 1885 to 1911, and the other a detailed statement of the situation in 1911.

1634 - The English Horticultural Market.

MARKET GARDENING

POHER, E. Le marché horticole anglais. — *La Vie Agricole et Rurale*, No. 46. Paris, October 12, 1912.

Although England possesses greatly developed horticultural resources, notably in Kent, Herefordshire, Devonshire, Somersetshire and Worcestershire, the local production does not suffice for the requirements of the large industrial towns. Thus the country is dependent on foreign importation and looks to France, Holland, Belgium, Spain, America, Australia, etc., to make up the deficit. Favoured by its proximity to the British Isles and owing to the excellence of its produce, France has for a long time come in for a large share of this import trade. It possesses most of the trade in the more perishable goods, while in that of the less perishable fruits and vegetables, France is continually more exposed to the competition of young distant countries, where fruit growing is carried out on large areas and constitutes a regular industry. It is thus that Californian, Canadian and Tasmanian apples have to a great extent supplanted similar European products on the English market, and that tomatoes from the Canaries compete with those from the Garonne Valley, etc.

(1) The production in Burma is included. (*Ed.*).

In order to succeed on the British markets, it is of the greatest importance to consider the customs and taste of the buyers, *i. e.* to understand the requirements of these markests.

The following information respecting the kind of fruits and vegetables which suit the needs of English consumers may possibly be consulted with advantage by those persons interested. Amongst the fruits which are most appreciated by British customers, the following species and varieties may be mentioned :

Apricots : Early de Boulbon, Royal, Luizet, Pêche, Suchet.

Black Currants : large and of a good black.

Cherries : Bigarreau Gros Cœur, Bigarreau Reverchon, Bigarreau Jaboulay, Bigarreau Napoleon, Anglaise hâtive, Reine Hortense

Strawberries : Royal Sovereign, Hoffmann, Docteur Morère.

Gooseberries : large and of a good colour.

Chestnuts : from Périgord.

Walnuts : Marlot, Brantôme, Corne.

Peaches : large and of a good colour.

Dessert Pears : Williams, Doyenné du Comice, Beurre Diel, Beurré Hardy, Duchesse d'Angoulême, Louise Bonne d'Avranches, Catillar, Doyenne de Merode. Second Choice : Curé, Jargonelle, Conseiller à la Cour, Beurré d'Amanlis Winter Pears : Beurré d'Hardenpont, Doyenné d'Alençon, Doyenné d'hiver.

Dessert Apples : Reinette grise, Reinette du Canada, Reinette du Mans, Reinette verte

Plums : Reine-Claude, Royale, Goliath, Victoria, Impériale.

Grapes : large black ones with firm flesh. The Moissac Chasselas are, for instance, less appreciated than the varieties Frankental, Gros Colman, and Muscats. Black Alicante Olivette and Aramon are also to be recommended.

Amongst the favourite vegetables of the English consumer may be mentioned :

Artichokes : these are increasingly liked, especially on the London market.

Asparagus, with violet tips and made up in large bundles (Argenteuil type) sells well.

Cauliflowers : there is a sale for larger quantities of these.

French Beans : the same may be said for these, until the local crop comes in.

Dried Onions : the sale of these is limited, owing to the competition of similar produce from Egypt and Valentia (Spain), which better suits the English market.

Early Green Peas : often find a ready market, until the local crop is ripe.

New Potatoes : find a large market in England, but often have to face severe competition. The varieties with white flesh are preferred to the yellow ones.

Salads : sell well in London, especially the Roman kinds and cabbage lettuces.

Great quantities of tomatoes are sent from the valley of the Garonne, etc., to England ; the sale might be even larger if the varieties grown were more adapted to the English taste.

It is recommended that goods should be despatched in non-returnable cases : boxes, wooden sieves, wicker baskets, baskets of different kinds made of rushes, small sacks, according to the kind of vegetable.

It is very important only to export sound goods, genuinely sorted into batches. The English public attaches great importance to the uniformity of the goods.

The usual practice is sale on commisision; direct sale is less common. The large English firms usually sell by auction, either on the markets, or on their own premises. At Covent Garden, the principal London market, the commission varies from 5 to 7½ % of the gross sale returns; it is from 5 to 8 % in the provinces.

There are, however, supplementary expenses : market dues, storage dues, verification of taxes, carriage, housing, packing, etc. It is usual for firms on the day of the sale to telegraph, at the request and at the expense of the senders, the amount realized by the goods.

1635 – The Composition of Flowering Bulbs and their Manurial Requirements.

FONDARD, L. and GAUTHIÉ, F. Composition et exigences des Bulbes-fleurs en éléments fertilisants — *La Petite Revue Agricole et Horticole*, Year XVIII, No. 428, pp. 223-224. Antibes, October 13, 1912.

The writers have already determined the composition of a certain number of flowering plants and their requirements as regards fertilizing substances, which latter they find to be very great (1).

The object of the present investigation was the production of dry bubs for sale and not forcing for flower-production.

The analytic results are summarized in Tables I and II.

TABLE I. — *Composition of Fresh Bulbs* ‰.

Species of Bulb	Water	Ash.	Nitrogen	Phosphoric Acid	Potash	Lime
Hyacinth	858.1	12.827	4.254	2.383	3.780	2.436
Gladiolus	730.7	15.242	4.553	3.016	3.490	3.105
Narcissus	825.1	5.981	2.137	1.119	0.839	1.208
Anemone	132.0	55.200	15.554	7.638	7.291	9.895
Ranunculus	127.6	52.169	27.611	8.724	7.118	6.255
Tulip	428.6	17.027	4.405	3.314	4.388	traces
Freesia	551.8	16.852	13.661	6.274	6.238	1.721
Cyclamen	743.9	20.590	4.330	2.356	3.441	3.344
Amaryllis	750.0	12.700	1.800	3.300	2.760	2.882
Lilium	779.5	17.772	5.953	2.381	6.667	traces
Jonquil	700.4	11.444	7.118	1 677	3.739	1.692

(1) See : FONDARD, L. and GAUTHIÉ, F.: Composition et exigences des plantes florales, en éléments fertilisants. — *La Petite Revue Agricole et Horticole du Littoral*, Year XVI, No. 363, pp. 20-21. Antibes, January 23, 1910. (*Ed.*).

TABLE II. — *Amount of Fertilizing Substances Removed per Rod.*

Species of Bulb —	Weight of crop lbs.	Nitrogen lbs.	Phosphoric Acid lbs.	Potash lbs.	Lime lbs.
Hyacinth	100	4.69	2.62	4.16	2.67
Gladiolus.	82.5	3.75	2.49	2.88	2.61
Narcissus	110	2.35	1.23	0.92	1.33
Anemone	27.5	4.27	2.10	2.00	2.72
Ranunculus	13.7	3.80	1.20	0.97	0.86
Tulip	82.5	3.63	2.73	3.62	traces
Freesia	27.5	3.76	1.72	1.72	0.47
Cyclamen	82.5	3.57	1.94	2.84	2.75
Amaryllis	82.5	1.48	2.71	2.28	2.38
Lilium	137.5	8.18	2.27	9.16	traces
Jonquil	41.2	2.94	0.69	1.54	0.69

In spite o f the similarity of a few figures, it is by no means easy to draw any comparison, with regard to the composition of the dry matter, between the different bulbs ; there are considerable differences, even between bulbs of the same family.

The composition of fresh bulbs is determined at the time of planting in August. As is seen by the first table, this is very rich and may be compared to that of seeds. The nitrogen contents of Freesia, Anemone and Ranunculus are particularly noticeable.

Most bulbous plants are greedy of potash ; this does not, however, apply to flowering bulbs, which, on the contrary, need an equal amount of phosphoric acid, but much less nitrogen. Nevertheless, the potash has a distinct qualitative effect, for its use increases the proportion of large-sized bulbs and improves their keeping properties. The same applies to phosphoric acid, which is increasingly employed in the form of superphosphate by bulb growers.

Except in the case of Lilium, the figures given in table II compare very well with one another. On the whole the phosphoric acid removed is little and the potash often very little. The requirements of the bulbs themselves are in any case much less than those of the same bulbs when grown to furnish cut blooms ; Anemone and Ranunculus are, however, exceptions.

The following is the balance-sheet for a plot of ground of one rod planted with hyacinths (under the conditions of the departments of Var and Alpes-Maritimes). Alongside these plants must be grown the mother bulbs for the production of offsets, as well as the offsets and the second-year bulbs which, at the harvest time, will be ready for the market. Thus the quantities of each required and the proportion of the whole area devoted to them, can be calculated :

Parent bulbs : 9 sq. yds., at about 50 per sq. yd., = 450
First-year bulbs : 6 sq. yds., = 1000 to 1500
Saleable bulbs : 15 sq. yds., at about 50 per sq. yd., = 750

The crop of saleable bulbs will be :

500 of 4 3/4 in. and over, at 5*s.* 6*d.* per 100
250 of under 4 3/4 in., at 2*s.* 9*d.* per 100.

Expenses per rod.	*s.*	*d.*
Preparation of the soil		10
Manures	1	6
Rent	3	0
Planting	1	0
Interculture	3	6
Watering	8	2
Lifting and sorting	3	0
Storing	3	0
Total	24	0

Receipts per rod.	*s.*	*d.*
500 hyacinth bulbs, at 5*s.* 6*d.* per 100	27	6
250 hyacinth bulbs, at 2*s.* 9*d.* per 100	6	10½
Cut flowers	1	7½
Total	36	0

There will thus be a net return of 12*s.* per rod.

1636 - International Pomological Nomenclature.

FRUIT-GROWING.

LEMOINE, HENRI. Nomenclature pomologique internationale. — *Revue Horticole*, Year 84, No. 19, pp. 442-443. Paris, October 10, 1912.

The necessity of facilitating the trade in new varieties of fruit between distant countries and of avoiding the drawbacks deriving from the confusion arising from the great number of synonyms, render indispensable the creation of an international nomenclature of the many varieties of fruit trees. The writer is of opinion that in order to draw up a catalogue of this kind the first thing to be done would be to fix exactly the name of each variety of fruit, accepting the name given it for the first time in its country of origin, after which, as synonyms for the older varieties, one name for each language might be admitted. Each country should have its own catalogue, with the local synonyms that might be thought advisable, in which each variety should be registered under a number, the same as in the international pomological catalogue.

The importance of such a catalogue would be considerable, because it could indicate the principal characters of each variety, including all

known varieties. It should besides be so arranged as to admit new varieties as they arise. It would thus constitute a sure basis for establishing the rights of whosoever first obtained a new variety ; with time, horticultural authors' rights might be established, as they exist at present in the fields of literature, art, science, etc.

The question of registering new varieties in an international bureau has been considered by many of the most eminent horticulturists, and since last year the Congress of the International Professional Horticultural Union has begun to discuss it. As for the idea of an international pomological catalogue, it was proposed by M. E. Cerny, of Tabor in Bohemia, at the Tours Congress held last year. This year's Congress at Limoges examined closely into the advantages that would accrue to fruit growers from these reforms, the necessity of which had been recognized. The following resolutions were adopted :

1. That a committee be appointed to study the creation of an international pomological catalogue in which every variety of fruit trees should be registered under a number.

2. That this registration be taken as a basis for the protection of the rights of those who obtain new varieties of fruit trees.

1637 – **The Reconstitution of Vineyards in Hungary and Austria** (1).

TELIKI, ANDOR. La Reconstitution du Vignoble en Hongrie et en Autriche. — *La Revue de Viticulture*, Year 19, Vol. XXXVIII, No. 981, pp. 389-391 Paris, October 3, 1912

The phylloxera crisis was especially serious in Hungary. In less than 15 years, the greater number of the vineyards were infected, and the production fell from 154 million gallons in 1880 to 44 million in 1892, only rising to 88 million in 1904. The consumption of wine, which had been about 6½ gallons per head per annum, fell, in spite of considerable importations from abroad, to 1 ¾ gallon in 1898. The Government and the proprietors made strenuous efforts to save the Hungarian vineyards, but reconstitution only began to make some progress towards the end of last century, when the vine-growers saw that grafted vines resisted the attacks of the insect, and that the crops obtained from the new vines equalled, and even excelled, those yielded by the old.

But the task was difficult, for this work of reconstitution followed so close upon that effected in France, that the Hungarian vine-growers had no opportunity of profiting by the experience gained by their fellow workers in France as regards adaptation. Further, in order to prevent the introduction of black-rot, the Government strictly forbade the importation from France of the carefully selected stocks and young vines, so

(1) See No. 344, *B.* Feb. 1912 ; No. 927, June 1912 (*Ed.*).

that the Hungarian vine-growers were forced to do their own crossing and selecting in order to obtain the stocks necessary for the reconstitution of the devastated vineyards.

At first, Clinton, Taylor, Vialla, Delaware, and other varieties of direct producers were imported from France ; these, however, were quickly uprooted, and they were succeeded by grafted vines imported from France, and grafting was practised on varieties of Riparia and of wild Rupestris. The results were very unsatisfactory. The Solonis and Gamay-Couderc vines were not sufficiently resistant to phylloxera, and in their turn disappeared. After many years of failure and discouragement, Riparia-Gloire and Rupestris du Lot were produced. On official recommendation, 90 per cent. of the vineyards were replanted with the former stock ; this was a great mistake, for it soon appeared that Riparia-Gloire was only suitable for rich, deep, fertile soils, free from lime and from excess of moisture. The result was that the vineyards replanted with these vines which were situated on rather dry slopes rich in lime were again destroyed and the vines, which before the advent of the phylloxera used to clothe the hill-sides, now invaded the fertile plain. Immense vine plantations were made on the sands extending between the Danube and the Theiss, where the phylloxera could not develop, and the products of the vines grown on the slopes from which the celebrated Hungarian wines had before been made, could not hold their own against the competition of the wines produced on such a large scale and at a low price.

The crisis of wines of first quality still continues. The owners of the vineyards situated on the sandy plains grow rich, while the producers of first-class wines can scarcely make a livelihood.

Nevertheless, in the face of all these difficulties, the Hungarian wine-growers have been working assiduously, and by relying on the results obtained by the French vine-growers, they have arrived at the following conclusions regarding the adaptation of the different stocks :

Riparia-Gloire : a stock suitable for fertile, moist, deep soils, free from lime ; it yields a good and regular crop. It has, however, the disadvantages of requiring a large amount of manure, suffering much from drought, and being short-lived. It can with advantage be replaced by different Americo-American hybrids, and especially by Riparia × Berlandieri.

Rupestris du Lot : a good stock ; it is strong and productive, but often too late. It is of considerable importance in the southern districts, especially in Istria and Dalmatia.

Solonis : this is almost completely eliminated, as it is not sufficintly resistant to phylloxera.

Riparia Rupestris: it is only of late years that the plants brought from France have begun to spread, especially in Transylvania. The same applies

to *Solonis* × *Riparia*, which makes, however, a good stock, being vigorous, fertile and damp resistant.

Mourvèdre × *Rupestris* and *Chasselas Berlandieri* 41 *B* have not been widely grown; they need a warm climate.

Aramon × *Rupestris Ganzin No.* 1 does well on warm calcareous soils (up to 40 per cent.). It is much planted with good results.

It seems that *Riparia* × *Berlandieri*, which is already much grown, is the stock which will be cultivated in the future in preference to all the new hybrids.

In Austria, the phylloxera appeared almost at the same time as in Hungary, but it developed there much more slowly. The Austrians had thus time to prepare for the reconstitution with American stocks; they made careful adaptation experiments, using the results of the researches carried out in France and Hungary. The varieties used in reconstitution were almost exclusively: Riparia-Gloire, Rupestris du Lot and Berlandieri × Riparia. All other stocks are of very secondary importance in this country. The Austrian vine-growers obtained very satisfactory results, and being most generously aided by the State, they are pushing forward actively the work of replanting their vineyards.

1638 – Vine-Growing in Chile.

VALDIVIA URBINA, V. La Viticulture au Chili. — *Revue de Viticulture*, Year 19, Vol. XXXVIII, No. 978, pp. 307-310, 3 figs. Paris, September 12, 1912.

The vine has been cultivated in Chile from the commencement of the colonization of that country, ever since the introduction of the Cuzco vine from the Canaries; but the industry made little progress until the latter half of last century. Then ensued a period of revolution as regards the choice of the vines, methods of wine-making, the material used for the construction of the cellars, the arrangement of these, etc. The vines formerly grown have been replaced by French varieties, which have become well acclimatized and produce excellent wines.

At the present time, wine-growing has developed to such an extent that the annual production of 66 million gallons places Chile (1) eighth on the list of wine-producing countries, after France (1320 million), Italy (880 million), Spain (440 million), Algeria (176 million), Austria (100 million), Portugal (66 million) and Hungary (66 million).

The Chilian vineyards are divided into three zones: the northern, which extends from the province of Tacna to Aconcagua; the middle zone from Aconcagua to the River Maule, which separates the Province

(1) These figures are based on the total declarations at the Service of Inspection of alcohols; in reality, the national production amounts to twice as much. (*Ed.*).

of Talca from those of Linares and Maule ; and the southern zone from the Maule to Bio-Bio. Each of these districts is characterized by special climate, and general conditions.

The area of irrigated vineyards is estimated at 35 000 to 50 000 acres, and the extent of non-irrigated vineyards at 75 000 to 90 000 acres. Of the irrigated vines 80 per cent. are in the Provinces of Santiago and Talca; they are grown on wires and occupy the best soil in the plain, where water is abundant ; the systems of pruning adopted are either the simple or double Guyot, or the Cazenave and Guyot systems. Of the non-irrigated vineyards 88 per cent. are in the Provinces of Talca and Bio-Bio ; they are mostly situated on the heights and on the hills with gentle slopes ; here the vines are no longer trained on iron wire.

The wines obtained from the non-irrigated vineyards of the south are generally common, but with large yields, as in the South of France ; they are the produce of the vines of the country, can be sold during the year, and contain 9 to 12° of alcohol, according to district.

In the central region, French vines are met with almost exclusively. As a whole, about 25 per cent. of the vines in Chilian vineyards are French. They produce finer red, white and pale wines, generally of good quality. The following are some of the most liked, arranged in alphabetical order : Benitez, Conchali, Conchai, Toro, José Luis Coo, Macul, Ochagavia, Panquchue, Quinta Normal, Santa Rita, Santa Carolina, Santa Elena, Subercaseaux, Tocornal, Undurraga, Vial.

In the northern district of Atacama, from Coquimbo to the river Choapa, where the vineyards are irrigated and on the hills, or more or less flat ground, the vines are grown to produce table grapes, raisins and liqueur wines.

All the wine made in Chili is consumed in that country and wines from other countries are imported to the value of 3 to 4 million francs per year.

1639 - The Thirty Years' Record of a Grass Orchard.

HOOPER, C. H. in *The Journal of the Board of Agriculture*, Vol. XIX, No. 7, pp. 541-545. London, October 1912.

Cherries in Kent are chiefly grown in grass orchards, being either first planted on arable land, to be laid down to grass some ten years later, or planted direct into pasture. In either case the grass is grazed by sheep and not mown. The paper under review is an account of an orchard, chiefly of cherries, extending over thirty years, and shows the actual returns and the method of cultivation adopted during that period.

The orchard is situated in the parish of Sheldwich, near Faversham, in Kent — a district noted for its cherries — and from this orchard are sent some of the finest cherries that enter Covent Garden. It is interplan-

Summary of Yield of Fruit and Money Return for 30 Years from a Grass Orchard at Sheldwich, near Faversham, Kent.

	Total yield in 30 years 1882 to 1911	Selling price at Covent Garden	Average selling price	Average yield per annum *	Average money return per annum	Average annual yield of fruit per tree	Average money return per tree per annum
		£ s. d.	s. d.		£ s. d.		£ s. d.
97 Cherry trees yielded	6529 half bushels in 30 years . . .	1654 6 5	5 1 per half bushel	218 half bushels	55 2 10	1 bu. 1 gal.	11 4½
61 Apple » »	1188 bushels in last 24 years . . .	226 2 0	3 10 » bushel	49⅓ bushels	9 8 5	3 1/8 pecks	3 1
29 Pear » »	526 bushels in last 22 years . . .	98 0 6	3 8½ » »	24 »	4 9 1⅓	3 1/8 »	3 1
96 Plum » »	606 half bushels in last 13 years .	63 4 0	2 1 » half bushel	46⅓ half bushels	4 17 3	1 peck	1 0
50 Damson trees in hedges.	104 half bushels in last 7 years . .	10 8 3	2 0 » » »	15 » »	1 9 9	1 ¼ gallons	7
2 Walnut trees . . .	340 bu. in 30 years .	69 8 6	4 1 » bushel	11⅓ bushels	2 6 4	5 ½ bu. 1 gal.	1 3 2

Less rail and sale expenses (about 3*d.* each per half bushel = 13½ % or 2*s.* 8*d.* in £ on gross sale price) £	272 6 9	
Nett return from sales . . . £	1849 2 11	= Nett average yearly return £61 12 9
		Value of fruit consumed yearly in house £ 7 0 0
+ Consumed in house on an average £7 fruit yearly, in 30 years £	210 0 0	Total average return per annum . . . £68 12 9 + 4¼ acres = 16 3 0 per acre
		+ Sheep pasture, say . . . 2 7 0
Nett total . . . £	2059 2 11	Total yield of orchard per acre per annum . . . £18 10 0

* The addition of the amount of fruit consumed in the house would raise the yield by nearly 10 per cent.

ted with some apples, plums and pears, with damsons in the hedges. The orchard has been carefully treated, planted up, and inferior sorts regrafted, so that it has much improved during the last thirty years.

The area is about 4¼ acres, and the depth of soil (loam) and subsoil (brick earth) varies from 5 to 8 ft., below which comes the chalk. The natural drainage of the orchard is good. The oldest trees seem to be about 80 years old. The cherry trees were originally planted 34 × 32 ft. apart, and about twenty-six years ago eighty standard apple, cherry and plum trees were put in to fill up blanks, and plums were interplanted between the rows of cherries. The yield and money return are given in the annexed table :

Outlay. — The cost of pruning and replanting may be put at, say, 36*s.* yearly. Last spring the apple trees were sprayed with lime sulphur wash, and the previous spring with lime-wash spray ; the chief insect pest now troublesome is woolly aphis. Taking 1911 as an average year, cherry picking costs £17 8*s.* to pick 241 halves ; this includes bird-scaring for the three weeks before picking, paying the man who moves the ladders and " keeps " the birds 24*s.* per week for five or six weeks, and paying five or six women pickers 2*s.* 6*d.* each per day. In addition there is a gun license (10*s.*) for man scaring birds ; powder and shot ; supply and repair of ladders ; spray pump. There is also the insurance of the pickers against accidents (15*s.* for one man and five or six women for five or six weeks, to cover all legal liability), carriage of empty baskets at 1*s.* for 48 half-bushel baskets, cartage to the station, and packing paper for the baskets. These in the aggregate amount to a considerable sum, apart from rent and taxes. The rent of agricultural land in the neighbourhood is £1 10*s.* per acre, and that of the orchard £4 per acre.

A very important factor is the great variation in the returns, due to variation both in the yield and in the price obtained. For instance, it may be mentioned that the net returns from market for the best year, 1902, were £133 7*s.*, whilst for 1910, the worst year they were only £14 16*s.* The average price of the various fruits varied as follows :

Cherries, from 2*s.* ½*d.* per half in 1909 to 8*s.* 6*d.* in 1897.
Apples, from 3*s.* per bushel in 1891 to 7*s.* in 1890.
Pears, from 1*s.* 1½*d.* per half in 1909 to 3*s.* 4*d.* in 1884.
Damsons, from 1*s.* 4 $^{3}/_{4}$*d.* per half in 1907 to 5*s.* in 1902.
Walnuts, from 2*s.* 2½*d.* per bushel in 1909 to 6*s.* 8*d.* in 1884.

1640 – **The Pine-apple in Florida and Natal.**

JUMELLE, H. L'Ananas en Floride et au Natal. — *Journal d'Agriculture tropicale*, Year 12, No. 135, pp. 262-264. Paris, September 30, 1912.

Messrs. Hume and Miller divide pine-apples into three large classes, according to the colour of the surface and that of the flesh of the fruit,

the depth of the eyes and the length of the bracts. The classes are as follows: 1) the Queen class; 2) the Cayenne, and 3) the Spanish class.

Nearly all the pine-apples grown in Florida (98 per cent.) are Red Spanish; the Smooth-leaved Cayenne can only be grown under shelter.

In Natal, on the contrary, the Smooth-leaved Cayenne variety is much grown, as well as a smaller sort, the Small Natal, which is very near akin to the Ripley variety and to the Queen class.

The Pine-apple in Florida. — Pine-apples have been grown in Florida for about 50 years. They are cultivated on a strip of land a quarter of a mile to a mile and a half wide which extends between the Indian River on the east and the prairies on the west, and in a soil which is not especially favourable as far as fertility is concerned; it is siliceous, and coarse-grained, and its physical composition leaves nothing to be desired, as it does not retain water (the pine-apple cannot stand too much moisture); on the other hand, its poverty necessitates the use of fertilizers. As a source of phosphoric acid, bone dust and slag are employed; the application of superphosphates is apt to cause what is called in Florida "spike" or "long-leaf," a condition characterized by weak general growth, the formation of narrow, thick leaves and the inferior flavour of the fruit. The best potash salts are those free from chlorine, since chloride of potassium and kainit produce effects similar to that of the superphosphates. It is recommended to use per acre at least 800 lbs. of ground bones, 600 lbs. of dried blood (or about 1200 lbs. of cotton-seed meal) and 400 lbs. of sulphate of potash.

The following experiment shows how much the size of the fruit depends on the amount of fertilizer applied. A fertilizer consisting of slag, dried blood and sulphate of potash, and containing 4 per cent. of phosphoric acid, 5 per cent. of nitrogen and 10 per cent. of potash. was applied at the rates of 2000, 3000 and 3800 lbs. per acre. The crop from 100 plants was as follows:

Amount of fertilizer used	Crops from 100 plants				
	18's	24's	30's	36's	42's
lbs.					
2000	1	9	43	35	10
3000	2	22	59	14	none
3800	none	50	35	12	none

The pine-apples are designated 18's, 24's, 30's, 36's, and 42's according to the number required for the "half-barrel crates" used for dis-

patching them. The 24's are the best and the 42's the least appreciated. It is best, therefore, to use 3000 to 3800 lbs. per acre of the above-mentioned fertilizer.

In Florida, planting is done in the rainy season — July, August and September. Slips, shoots which have developed immediately at the base of the fruit, are chiefly planted and they bear fruit after 20 to 22 months. Suckers, shoots from the axils of the lower leaves, are more rarely used; the fruiting, though earlier at first, (12 months) becomes subsequently irregular. The plants are placed at intervals of 20 by 20 inches, or 20 by 24 inches, which gives about 15 000 plants per acre. After planting, the bud of each plant is sprinkled with cotton-seed meal, to prevent its being at once filled with sand, which would be very injurious to it. The fruits are cut when the centre of the eyes becomes flat, the angles are raised and the colour is greyish, which chiefly takes place in June and July.

The pine-apple in Natal. — For planting in Natal suckers are used by preference, or failing these rattoons (buds developing from parts of the plant underground). Sulphate of ammonia is an excellent fertilizer; superphosphates are only to be recommended in very small quantities (100 lbs. per acre). Potash causes the formation of larger, more succulent fruits of the best flavour; the use of sulphate of potash is much to be preferred to that of the chloride. Wood ashes are also to be recommended. The best fertilizer should consist, it seems, of the following compounds and amounts per acre: 100 lbs. superphosphate, 100 lbs. sulphate of potash and 500 lbs. of wood ashes.

In the Natal plantations, which are on the coast and situated on soils very superior to those in Florida, the space left between the plants is 6 by 3 feet; but they seem to do better if planted at 24 inches. The plants should not be kept longer than three years; at the end of this time, the weight of the fruit diminishes rapidly every year. Planting is done in September to November, and the crop is gathered at the end of a year. When the young plants fruit prematurely, and thus bear very small fruits, the latter should be removed; then a new bud develops at once, and fruits in its turn, at about the time of the general harvest.

1641 - Observations on the Yield of the Karité Tree (1) and the Varying Content of its Fruits in Oily Matter.

VUILLET, J. Observations sur le rendement du Karité et sur les variations de richesse de ses fruits en matière grasse. — *Journal d'Agriculture Tropicale*, Year 12, No. 135, pp. 283-284. Paris, September 30, 1912.

M. Houard, the Director of the Agricultural Station of Koulikoro (French West Africa) had the fruits of some twenty karité trees regularly

(1) *Butyrospermum Parkii*. See pp. 78-79, *B.* Nov. 1910; No. 835, March 1911; No. 2612, Aug.-Sept.-Oct. 1911. (*Ed.*).

collected and noted the dates of each gathering. In collaboration with the Hann laboratory, he made the following observations.

The objects of the investigation were to determine : 1) the average yield per tree ; 2) the content in oily matter of the fruits falling from the same tree at different dates ; 3) the relative richness of the fruits belonging to different forms.

Twenty trees differing very much in size and productiveness produced this year 433.1 lbs. of dry nuts, giving an average of about 22 lbs. per tree. The yield varied from 1 3/4 lb. (for a tree of 30 in. girth 3 ft. up) to 86 lbs. (a tree of 8 ft. 3in. girth). These 20 trees have been carefully marked and their annual yield will, in future, be noted regularly, so that in a few years' time a sufficiently accurate determination of the average yield of the karité tree in the Koulikoro district will be possible.

The chemical researches of M. Lemmet, Sub-Inspector of Agriculture at Dakar, have shown that the nuts gathered from the same tree at different dates from July 15 to August 15 in 1911 at Koulikoro, were perceptibly richer (2 to 3 per cent.) in fatty matter than those which fell before and after these dates.

This statement is of some interest from the commercial point of view, as affecting the time for putting the nuts on the European markets and for the sampling of the crop. On the other hand, from the agricultural standpoint, the comparative analysis of nuts belonging to quite different kinds has shown the differences which exist in the amount of fatty matter which they contain. It is worth noticing that the tree which produced the largest crop (86 lbs. of dry nuts) bore the seeds richest in fatty matters (an average of 57 per cent. of the dry kernels).

1642 – Two Trees with Oleaginous Fruits: "Usudi" and "Okoto".

Note relative à deux arbres à fruits oléagineux du Congo Belge — *Bulletin Agricole du Congo Belge*, Vol. III, No. 3, pp. 573-580. Bruxelles, September, 1912.

The two plants containing fatty matter mentioned by M. Mestdagh, the Sub-Director of Agriculture at Katako-Kombe (Belgian Congo), are named by the natives "usudi" and "okoto" respectively. The "usudi" has not yet been determined, but the "okoto" has been identified at the Brussels Botanic Gardens as *Pentadesma butyracea* Sabine.

The "usudi," which is a tree of 30 to 50 feet, is plentiful in the forests. Its fruits contain one to three seeds, which the natives cut into small pieces and expose to the sun ; the drying is completed on a frame placed over a hole in which a large wood fire is lighted. The fragments of desiccated seeds are then placed in a kind of funnel excavated in a mound of beaten earth. A fire is there lighted, and during the combustion the oil is collected in a vessel placed on the ground by means of a channel hollowed in an inclined plane, which facilitates its flow.

The "okoto," a tree of 50 to 60 feet, is less plentiful than the "usudi;" the two species are found growing side by side in some districts. The oil of the former, like that of the "usudi," is suitable for food, but the method of its extraction differs from that employed in the case of the "usudi." Desiccation is effected by smoke and the hot air passing through a frame on which the pieces of seeds are put. When dry, the seeds are placed in a mortar and reduced to powder. After being pounded for a long time, the powder becomes an oily paste. The latter is put in small quantities at a time into a large earthen pot filled with water, which is made to boil; when a sufficient amount of oil rises to the surface, it is decanted and preserved in pots.

Prof. Heckel, who has written several articles in the *Annales de l'Institut Colonial de Marseille* on *Pentadesma butyracea* gives the following information respecting it:

"The fatty matter which can be obtained from the seeds is at ordinary temperatures a solid, yellowish-white oleostearine without smell or taste, when fresh. In French Guinea, this fatty substance, under the name of "Lamy or Kavya butter," is much used and the European palate soon gets accustomed to it. By means of solvents, 46.75 per cent. of fatty matter containing 95.50 per cent. of fatty acids can be obtained. The fat may thus be very important in the manufacture of candles. The cakes present very special characteristics: absence of starchy or sugary matter, low proportion of protein, and presence of about 0.164 per cent. of phosphoric acid in the form of phosphates. The large proportion of tannin which this cake contains prevents its being used as a cattle feed, while its deficiency in nitrogen renders it of little use as a fertilizer. Its high tannin content would, however, allow of the cake of these seeds being employed in dyeing for the purpose of fixing the colours in the tissues.

The fruits of *Pentadesma* are fairly large, and pea-shaped, and contain from 5 to 12 fleshy seeds, which are only set free on the decay of the pulp.

1643 – **Forest and Landslips.** FORESTRY

ZUFFARDI, P. La foresta e le frane. — *Giornale di Geologia pratica*, Year X, Parts II-III, pp. 101-129. Parma, 1912

Among the conflicting opinions on the preservative action of forests against landslips it is certain that forests have a very important action in modifying the surface of the soil. The writer poses the following questions: 1. Is deforestation favourable to the production of landslips? 2. Are forests useful against landslips?

It might be answered at once that if landslips — as is generally admitted — are almost always caused by the circulation of water, in a wide sense, and if it could be demonstrated that forests are capable of exerting

a beneficial influence on the complex action of water (washing away, impetuous rushing, infiltration, dissolution and lubrification of inclined planes) the certainty would be at once acquired that forests exert a most useful action against landslips.

There are some, though, who, without solid reasons, call forests true active causes of disintegration and believe them capable in many cases of easily causing superficial landslides ; the writer proposes to examine the truth according to facts.

The protective action of the forest is mainly due to the mechanical function of the roots in binding the soil and to the protection against atmospheric agency afforded by the cover of decaying vegetable matter that moderates and regulates the penetration of the surface water.

As an instance of the binding and retaining action of roots on the soil particles the suggestive example of the " erosion pyramids " of the valley of Portalisio (Sondrio, Italy) are often mentioned, where some average sized plants have protected an adequate extent of soil, giving origin to fine and robust pyramids of the same size as the mass of earth occupied by the roots.

In considering roots as a means of consolidating the surface of the soil, a distinction must be made according to the varying resistance of the rocks. It is true that the roots of a plant by their growth tend effectively to push asunder the rocks between which they penetrate, but even in this case their binding power does not cease and it remains to be seen which of these two contrary actions predominates. In this connection it may be noted at once that if the roots penetrate into the crevices, these must have previously existed ; and then a fissured rocky mass without vegetation is certainly not free from still more powerful causes of dissolution, such as temperature, water, and frost, the action of which is much tempered by the covering afforded by forest growth.

The principal types of landslips are the following:

Subsidence slips are due to the saturation of layers of varying thickness which fall without the presence of a real sliding plane.

Superficial slips (lame) are the shallowest, whilst *subsidence slips* occur most frequently in impermeable soils, such as phyllites, scaly clays, clay schists (flysch), blue clay marls and masses of detritus with much clay. Water, by infiltration in such soils, renders them pasty and heavy and if the slope is sufficiently steep the force of gravity causes the saturated layer to form a superficial slip (lama) ; if instead the inclination is less marked, and the formation is more permeable a subsidence slip may occur.

These slips may be avoided by preventing the water from saturating the clayey masses and from collecting on the surface into rivulets. This result can be easily obtained by means of forests, which lower the level of the water table and favour superficial drainage by means of evapora-

tion, capillarity and absorption. Besides, the covering of decaying vegetable matter protects the clayey rocks against the disintegrating action of extreme temperatures and thus hinders the easy infiltration of water.

Disintegration slips or *cliff falls* have not a plane on which they slide, but they are due to a disintegration of the rocks along the original fractues (synclasis) or more frequehtly the epigene ones (plesioclasis) which break them up, until, the slope being sufficiently steep, they fall, some times in great quantities and with disastrous effects. These landslips occur frequently in hard rocks, like limestones, dolomites, compact sandstones, granites, gneiss, pophiolites etc. Their principal causes are the same that originate and favour disintegration, such as changes of temperature, frost and also the formation of rivulets on the surface which may be a very efficient cause of demolition. The protective action of forests against all these factors of destruction is well known.

Landslides differ from the preceding inasmuch as they have a well defined plane, determined by the special stratigraphy, upon which they slide. Here also the action of water must be guarded against, and two principal cases are to be distinguished : 1) The stratified mass which forms the plane upon which the sliding occurs is beneath a mass of unstratified material such as clay for instance, and in this case the forest can well diminish the probability of a slide occurring. 2) The stratified mass is above the impermeable clayey mass which acts as slide ; in this case the water may easily reach this plane through the crevices of the upper strata and the protective action of a forest in retarding or diminishing the sliding of the soil will be readily understood. Man is powerless against this kind of landslide, but he has in the forest a powerful natural moderating force which allows also the utilization of the area subject to motion and prevents the added action of other superficial causes of injury, such as the forming of rivulets and the disintegration by weathering.

The *landslips due to degradation* happen when the foot of any kind of rock has been damaged by erosion. This form of injury is almost always caused by water either in the shape of rainfall or of current.

In the first case, as rainfall, water can do very considerable damage when a platform of compact rocks rests on a basis of easily disintegrated formation, which on being worn away leaves without support the upper mass which breaks up and falls as the base disappears. A clothing of trees is a very effcient protection of easily eroded rocks and consequently also in this case a mantle of forest would prevent the process of erosion.

It is more difficult to demonstrate that forests have a protective action against the erosion caused by running water, and indeed it may be said that they have none, directly. Indirectly, however, they may prove beneficial inasmuch as they moderate the fury of floods. In conclusion,

it may be stated that this kind of landslide requires other means of defence besides forests.

The utility of forests against the four above mentioned simple types of landslips explains their utility against *compound* landslips, namely those partaking of the nature of two or more simple forms. The most frequent compound slips are derived from the union of those due to erosion with some of the preceding types and especially those of subsidence. In such a case the slope ought to be reforested in order to eliminate the subsidence, while the base is proected by other works of defence against the erosion of the foot, which however frequently continues in spite of all efforts.

There are cases in which landslips have happened in woodlands, but they do not demonstrate the uselessness of the forest as a protection, but only that its beneficial action has been outweighed by destructive agencies. The felling of forests in order to lighten the weight on the instable soil is not considered advisable by the writer, who thinks that the advantage thus obtained is very doubtful in comparison with the numerous disadvantages arising from the new cases of injury set on foot by the removal of the forest.

The writer answers the two questions put at the beginning of this paper, as follows:

There has been in the past a great deal of exaggeration in considering forests as the only remedy against landslips, and sufficient by themselves to reclaim any locality; while deforestation was believed to be the principal, if not the only, cause of landslides. This was no doubt an exaggerated view, but not so harmful as the opposite opinion that tends to deny that forests in themselves are factors of stability and that reduces to the lowest terms their importance as means of defence against landslips.

On the contrary from the foregoing it appears:

1. That in several cases forests alone are a sufficient protection against landslips.

2. That forests are in may cases *necessary* and valid aids to other means of defence.

3. That forests are never injurious to the stability of slopes, on which they always exert a protective action.

4. That deforestation alone has frequently been sufficient to cause, to favour and to develop landslips.

5. That deforestation has always been found useless and frequently injurious to the stability of slopes.

LIVE-STOCK AND BREEDING

1644 - **Poisoning of Stock by *Silybum Marianum*, *Lotus australis*, Immature Sorghum and *Adonis autumnalis*.** HYGIENE

1. HENRY, MAX. Variegated Thistle (*Carduus marianus*) as a Poison Plant.
2. MAIDEN, J. H A new Poison Plant (*Adonis autumnalis* L.).
3. GUTHRIE, F. B. Poisoning of Stock by Plants.

The Agricultural Gazette of New South Wales, Vol. XXIII, Part 9, pp. 807-812. Sydney September 1912.

The milk thistle or variegated thistle (*Silybum Marianum* = *Carduus marianus*), very commonly distributed in New South Wales, is here responsible for much mortality among stock, particularly cattle. It was held that cattle would be harmed by this plant from tympanitis (hoven). But, as evidence accumulated, it was seen that many cases could not be attributed to this cause, as the circumstances under which death occurred bore a close resemblance to mortality due to poisoning by immature sorghum (*Sorghum vulgare*) or blue couch grass (*Cynodon incompletus*), in both of which instances hydrocyanic acid has been demonstrated as the cause of death. Analysis has so far apparently failed to detect the presence of cyanogenetic compounds in variegated thistle, but from the symptoms of the diseased cattle and, in some cases, by post-mortem appearances (inflammed condition of the stomach and intestines), it would appear not improbable that death has been due to prussic acid poisoning. The mortality from this cause is more prevalent when the thistle shoots about March, and then becomes stunted with dry weather.

M. Guthrie directs the attention of stock-owners to the poisonous nature of *Lotus australis* var. *Behrii*, a fairly common plant in New South Wales, which has recently caused a number of cases of poisoning of stock. Samples of this plant were forwarded to the Laboratory of the Department of Agriculture of New South Wales and were found on maceration with water to yield 0.007 per cent. prussic acid (anhydrous). (The same poison, but in greater quantity has been found by Messrs. Dunstan and Henry in *Lotus arabicus*, a plant which has been found to be poisonous to stock in Egypt).

Another case of the poisoning of cattle by eating sorghum in an early stage of its growth is reported.

The recognised antidotes in the case of prussic acid poisoning are the following:

Subcutaneous injection of 1-60th grain of atropin.

Subcutaneous injection of ether.

A mixture of ferric and ferrous salts with magnesia (as a drench).

Inhalation of ammonia or large doses of aromatic spirits of ammonia (as a drench).

Adonis autumnalis L. has been reported as a weed in New South Wales since 1905. Now it is also reported as a poison plant, having killed some horses which had been fed on this plant intermixed with lucerne hay.

Adonis autumnalis originally in Australia probably escaped from gardens and was then disseminated in its present localities in chaff or in dirty seed.

ANATOMY AND PHYSIOLOGY

1645 – **Studies on the Reductase of Liver and Kidney.**

FRASER HARRIS, D. and MAUDE-CREIGHTON, H. J. in *Proceedings of the Royal Society*, Series B, Vol. 85, No. B582, pp. 486-494. London, October 1912.

The notion has steadily been gaining ground that the reducing powers of animal tissues are due to enzyme action. Evidence was adduced in 1910 by experiments made by the former of the two writers, that this so-called " reductase " was active in the press-juice of the liver and kidney of sheep, ox, horse and frog ; which reduced more or less perfectly soluble Prussian blue, methylene blue, and sodium indigo-disulphonate. This effect was not brought about in the case of a boiled control.

It seemed of much importance to make experiments respecting the following points :

the rapidity with wich the press-juice of the liver loses it reducing power, its method of behaviour in the presence of some stable, but reducible substances, *e. g.* sodium nitrate, the variations in its activity with changes of temperature, the relation of the hepatic catalase to the reductase.

The following experiments on the action of press juice of liver upon methaemoglobin show that the former acts exactly in the manner of a reducing agent. It was also found to decompose rapidly hydrogen peroxide. Since it has been observed by Spitzer that the liver is rich in catalase, it is most probable that the decomposition of hydrogen peroxide by liver press juice is due to the presence of this enzyme ; if, however, the former contains a reducing endo-enzyme, as the writers suppose, it is not improbable, that the decompositions of the hydrogen peroxide may be due to the combined action of the catalase and the reductase. It has already been shown by Mr. Fraser that soluble Prussian blue is readily reduced by press juice from liver and kidney ; this action has been confirmed and further studied in the present investigation.

A number of experiments were carried out with a view to determining the relation of the reducing activity of the press juice to the temperature. A mixture of press juice and soluble Prussian blue cooled to — 14° C. changed from blue to green, showing that at this low temperature the reductase had not lost irs property, but that the latter was much reduced.

When the two substances were separately brought to a temperature of 100° C. and then mixed, the action of the fresh juice was completely destroyed by heating to this temperature for two or three minutes.

The writers further proved that the liver reductase rapidly reduces ferric salts (ferric chloride) into ferrous salts and nitrates into nitrites. They propose using such redution of nitrates as a basis for the quantitative study of reductase.

The probability of the enzymic action of tissue reduction is further confirmed by the effect of certain protoplasmic poisons lately investigated by Mr. Fraser. Certain virulent protoplasmic poisons inhibit reductase in virtue of their acidity rather than through their toxicity ; this is in accordance with the fact that acidity inhibits the activity of many enzymes.

The writers lay a considerable degree of stress on the fact that reductase is able to reduce chemical substances differing very widely in structure, propensities and stability. Not only can it reduce compounds containing oxygen, such as methaemoglobin and sodium nitrate, but with equal potency, substances which contain no oxygen and are of a relatively stable nature, such as ferric chloride and soluble Prussian blue.

1646 – Influence of Age and Breed on the Utilization of Forage by Cattle.

ARMSBY, HENRY PRENTISS and FRIES, J. AUGUST. Der Einfluss der Rasse und des Alters auf die Ausnutzung des Futters beim Rindvieh. Gemeinschaftliche Versuche des Bureaus für Tierindustrie des Landwirtschaftsministeriums der Vereinigten Staaten von Nord Amerika und des Instituts für Tiernährung des Staats Colleges in Pennsylvanien. — *Landwirtschaftliche Jahrbücher*, Vol. XLIII, Part 1, pp. 1-176. Berlin, 1912.

It is generally well known that individual animals, especially cattle, utilise to a greater or less extent the forage that they consume. Such differences have been mostly attributed to physiological causes, and it was also admitted that the diversity of breed had some influence.

The object of the present researches was to study experimentally this problem, by determining in two animals of widely different breeds their digestive power and production of energy while using the same feed.

For the experiment two young steers were chosen. One, a pure bred Aberdeen-Angus, was a typical beef animal ; the other, a cross with much Jersey blood, was rather of a milk producing type. These animals at the beginning of the experiment, in October 1904, were respectively 8½ and 11 months old ; for upwards of two and a half years they were kept under almost continuous observation. During this time, excepting for certain periods during which the balances of the metabolic processes and of energy were determined by means of the respiration calorimeter; the animals were fed with ordinary rations, adapted to their growth. They were kept

in the condition of store animals and at no time submitted to fattening. The food chosen was the same for both animals throughout the experiment; the different qualities of grain were given to both in corresponding quantities. The live weight was determined at least once a week and in three successive days at the end of every month. Four times, namely in December 1904, July 1905, November 1905 and June 1906, the digestibility of the total ration and the balance of nitrogen were determined. During each of the three winter periods each animal was subjected to experiments with the respiration calorimeter in order to determine the utilizable percentage of the potential energy contained in the food consumed. During the first winter, 1904-1905, the food supplied during the experiments with the calorimeter was different from the usual food. In the two following winters the quality of the grain fed was the same, but the quantities were different.

Naturally the researches with the calorimeter extended also to the determination of the digestibility of the rations and to the balance of nitrogen of the animals.

After the end of the experiment in the spring of 1907 the animals were turned out to pasture for the summer ; in the autumn they were fattened and slaughtered in order to get their weight in butcher's meat.

The results of the experiment may be summarized as follows :

The experiments with the respiration calorimeter do not show that the breed and age of the animals have any essential influence on the percentage of food digested or on the quantity of energy produced by its transformation. As for the percentage of transformable energy which was utilized for the maintenance or production of the animals, only a small difference was observed in favour of one breed, and, in feeding with grain, in favour of the older animals ; it is however doubtful if they were sufficiently important to have any bearing in practice.

With the limited grain ration during the periods between those of the calorimeter experiments the cross bred consumed realatively more hay than the pure bred ; it attained the same total increase of live weight but a greater increase relatively to the initial weight ; on the whole it consumed somewhat less air-dried food per unit of gain.

This apparent divergence between the results of the experiments with the respiration calorimeter and those of the rest of the experiment is probably mainly due to the difference in the composition of the live weight in the two animals. The balances of nitrogen show that the cross bred had a much greater tendency to accumulate proteids than the pure bred ; while on the other hand the calorimeter experiments show that the latter had a considerably greater accumulation of fat. In other words the increase of weight of the cross bred, compared with that of the pure bred, was produced in greater proportion by living tissues containing

nitrogen, with their relative water content, and in a lesser degree by fat; therefore this increase of weight represents an essentially lower accumulation of alimentary energy (of reserve tissues). The results observed at the slaughter house lead to the same conclusion.

From the data collected by the writers on the energy utilizable from the rations, the conclusion is arrived at that 1 lb. of live weight gained by the pure bred steer was obtained by an accumulation of energy 40 per cent. greater than that of the cross bred. The quantity of energy required for the maintenance of the cross bred was, for the same live weight, 18.7 per cent. greater than that for the pure bred steer. Therefore the latter was enabled to employ a relatively greater proportion of the energy of his ration for the production of growth. As for the needs of maintenance within the age limits of 14 and 39 months, a marked influence of age was observed in as much as the needs diminish as the animals grow older.

In those respiration calorimeter experiments in which a greater quantity of grain was fed, it was found that the pure bred steer possessed a remarkably higher aptitude for assimilating food than the cross bred; that is, he could be fed more abundant rations than the latter and utilize them to the same degree.

Though the researches of the writers did not lead to the demonstration of essential differences in the physiological processes of the utilization of food by the two animals, yet they show clearly an economic advantage in favour of the pure bred steer in comparison with the other one; in the first place because his maintenance requirements were relatively lower, secondly because he possessed the aptitude for ingesting a larger quantity of food than necessary. These two factors allow the pure bred animal to produce a considerably greater quantity of human food in the shape of meat and fat for every unit of food eaten. In preceding researches this difference was revealed by the inferior growth of the cross bred steer, which, notwithstanding its greater increase of live weight, did not succeed in surpassing the pure bred.

Contrary to the conclusions arrived by the writers from previous experiments, it appeared that the utilizable quantity of energy contained in the grain fed above or below the maintenance ration was essentially the same, and that in both cases the values of the energy determined by means of the respiration calorimeter agreed fairly well with those which had been calculated from the chemical composition with the help of Kellner's well known factors. On the other hand, with hay the degree of utilization below the maintenance ration was considerably greater than the result obtained by calculation with Kellner's factors for the percentage of utilization of the quantities above the maintenance ration.

Especially for the pure bred steer, and in a lesser degree for the cross bred, the rations which contained a lower proportion of utilizable energy

and especially a lower proportion of digestible proteids than that required by the usual practice of farmers, gave highly satisfactory increases of live weight.

FEEDS AND FEEDING

1647 - **Physiological Effect on Growth and Reproduction of Rations Balanced from Restricted Sources.**

HART, E. B.; MC COLLUM, E. V.; STEENBOCK, H., and HUMPHREY, G. C. in *Twenty-Eighth Annual Report of the Agricultural Experiment Station of the University of Wisconsin*, pp. 131-205. Madison, Wis., 1911.

The study of feeding has hitherto dealt mainly with the question of the nutritive contents of the various feeds and the manner in which the animal organisms turned these to account. In the given standards, the content of the ration in digestible substances, or in disposable energy was alone regarded, and not the *physiological* value of the feed. It is, however, possible that different food-stuffs containing the same amount of nutritive substances are not equally valuable to the animal organism, but can have a different *physiological* effect.

For the investigation of these points, the writers carried out a feeding experiment at the Agricultural Experiment Station of the University of Wisconsin from 1907-1911. They bought for the purpose 16 grade Shorthorn heifer calves. When purchased, the calves were 5 to 6 months old and weighed 310 and 413 lbs. They were divided into four lots of as nearly equal total weight, health and vigour as possible, each consisting of 4 head.

Three of the lots were fed one kind of plant (maize (corn), wheat or oats) while the fourth was given a mixture of these.

Lot I was fed corn stover, corn meal, and corn gluten (a preparation rich in protein). Lot II wheat straw, wheat meal and wheat-gluten, Lot III oat straw and rolled oats. Lot IV was given a ration consisting of equal parts of the three above rations. The proportion of nutritive substances in each ration was about 1 : 8.

The rations were made up during the first two years in such a manner as to correspond to Wolff's standard ; later, Kellner's and Armsby's standards were used as a base. In fine weather, the animals were allowed to take exercise in a run free from vegetation.

The gain in live weight of the animals is given in carefully drawn up tables. From them no definite opinion can be arrived at as to the superiority of one food stuff over another.

Digestion trials also showed little difference between the three lots with regard to the percentage of the feeds digested. These experiments were carried out on 2 animals of each lot for three years, the trial period being in each case 7 days. The appearance of the lot (condition of coat

etc.) showed some differences, in so far as the lot to which corn was fed looked in the best condition and that to which wheat was given in the worst.

At the end of the first year of experiment, this difference was not so noticeable as at the close of the second. It should be mentioned that the calves given oats, eat far less salt than the others.

The heifers, on reaching sexual maturity, were all served by the same bull; and gave birth to their calves about two years after the beginning of the feeding experiment.

These weighed on an average as follows: Corn lot 73 lbs., Oat lot 71 lbs., mixed rations lot 59 lbs. and wheat lot, 46 lbs.

The heifers of the last lot calved 16-34 days before the usual time and those of the corn lot from 3-10 days early. In this respect the two other lots come midway between the above-mentioned ones. The vitality, as far as could be judged, corresponded with the weight of the calves. Those which were the offspring of the corn lot were all strong and lived; one of the calves from the wheat lot was born dead, one lived for two hours and another for twelve; the fourth was very weakly and died on the 12th day.

The other lots were also intermediate as regards their calves. Next year 1910, although another bull was used, the results as regards the calves were the same.

In 1909, the milk yield of the corn lot was the largest (24.03 lbs. daily per cow in the first 30 days after the disappearance of the colostral milk) the mixed food and oat lots were nearly equal, with 19.82 and 19.38 lbs. of milk. The milk yield of the wheat lot was only 8.04 lbs. In 1910, the milk yield of all the lots was somewhat higher, the oat lot still gave somewhat more milk than the corn lot, while the wheat lot occupied the last place.

Analyses showed only very small differences in the chemical composition of the milk, the latter was normal in all the lots. The milk of the wheat lot showed, however, in both years a higher titration factor than the others. This is the more noticeable, since the urine of this lot has an acid reaction with litmus and that of the others, either a neutral, or alkaline reaction.

The influence of the different feeds upon the tissues of the animals was also studied, for 33 months after the beginning of the experiment, one animal from each lot was killed, and different portions of its body examined. Only small differences in chemical composition were observed. Three years subsequent to the commencement of the experiments, there were still 10 animals left (1). In the case of these, the rations were altered

(1) Besides the four used for the investigation of their tissues, one cow died of anthrax and another had to be killed owing to its having an affection of the uterus.

in such a manner that each cow belonged to a different lot to that in which it had been previously. The lot that received mixed food was suppressed.

The animals to which corn was now fed, visibly thrived on the change. those which had hitherto been given oats and wheat, fell ill soon after the change of diet. They recovered as soon as they were fed corn for some time.

The heifers of the corn lot had also this time heavy calves (one was an abortion) ; the rest of the heifers either were barren, or their calves were weak, very small, and incapable of living.

The experiment has shown, that the present method of estimating the value of feeds does not suffice to obtain their whole value. The food rations of all the animals used for the experiment were according to Wolff's standard, the first two years, and afterwards according to that of Kellner and Armsby, nevertheless their effect upon the animals, which were otherwise living under identical conditions, was very different. Only the heifers fed on corn remained in good health throughout.

1648 – On the Influence of Industrial By-products on the Quality of Milk in Connection with its Use as Food and in the Dairy.

FASCETTI, GIUSEPPE. Dell'influenza dei residui industriali sulla qualità del latte in rapporto all'alimentazione ed al caseificio. — *Bullettino dell'Associazione Agraria Friulana*, Year 57, Series VII, Vol. 29, Nos. 9-18, pp. 253-260. Udine, September 30, 1912.

The appearance of industrial by-products which are now extensively used in feeding cattle and which besides bran and pollards comprise the residues of oil seeds or cakes, brewer's or distiller's grains, pomace, beet slices etc. has raised a number of problems connected with physiology, the economics of animal husbandry and other subjects, about many of which, especially those relating to the effect of the above by-products on the character of animal products much uncertainty still prevails.

The study of these feeds may be conducted in three directions : the economic, the technical and the hygienic.

From the economic point of view the use of by-products represents the attainment, with the least expenditure, of the greatest possible production of meat, milk or work. From the technical standpoint they must be considered in connection with the disturbing influences they may exert on the transformations of animal produce, while their hygienic aspect refers to the qualities and character of the final produce which must not in any way be injurious as food, especially for children.

The industrial by-product that successfully bears examination from these three points of view may be pronounced truly excellent.

Such truly excellent by-products are more numerous than is generally supposed, but there are not few of these industrial residues in which their

economic advantages are not accompanied by corresponding technical and hygienic merits.

The writer treats chiefly of this latter group, limiting his considerations to the technical and hygienic effects of the by-products on milk only.

Leaving aside the not very important by-products of industries which work up animal products, the most common by-products of a vegetable nature may be divided into five groups:

Mill residues: Brans, pollards, sharps.

Grain and potato starch factory residues: potato, maize, wheat rice pulps, (both fresh and dry); gluten.

Sugar factory residues: beet pulp (fresh, dry, ensilaged, pressed); molasses.

Residues from fermentation industries: brewer's and distiller's grains (fresh and dry), malt and malt germs, wine pomace (fresh, dry, and free from stalks), pomace meal.

Residues from seed oil factories: oil-cakes and oil-cake meal.

Experience has proved that the by-products of the milling and starch industries when they have been kept wholesome do not impart to milk any property liable to impair its value as human food or as raw material for the dairy.

A few of the by-products of the oil-seed pressing factories have an unfavourable effect on the health of animals, so much so that some, colza cake for instance, can even cause their death, and on the properties of milk or some of its constituents.

It has been repeatedly demonstrated, that whilst oil-cakes do not cause perceptible differences in the quantity of the fat content of milk, they alter significantly the proportion of the various glycerids which compose it and induce noticeable modifications in the character of the butter.

Palm, coconut and linseed cakes, and cotton meal give the fat content of milk certain qualities that are not revealed by immediate analysis but which show in the butter by a different consistence, melting point etc., whereas wheat bran, sesamum cake, and beet slices raise the index of volatile acids. Among oil-seed cakes the injurious ones are sufficiently distinguished from the good ones, among which linseed and maize cake occupy a prominent position.

Decidedly injurious to the production of milk for infants and for the dairy are almost all the by-products of sugar factories and of the industries based on fermentation.

The dangers attendant on the use of these by-products does not lie so much in the very great amount of water they contain (in some cases as much as 90 per cent.) and consequently in their poverty in utilizable

materials as in the rapid deterioration to which they are liable and to the toxic substances which are formed in them.

The importance of investigating the effects of these two groups of residues on milk is beyond discussion. Only of late years have they become the subject of scientific research.

They bear both upon the quantitative as well as upon the qualitative composition of milk. Quantitatively they cause variations in the percentage of the constituents of milk; fat, lactose, proteids, and ash, as is ascertained by a summary analysis: Qualitatively they modify the general physical, chemical and fermentative properties of milk and usually escape detection by a summary analysis.

The qualitative influences may be grouped as follows:

Qualitative influences of a chemical nature, causing abnormal coloration and tastes, the presence of toxic or aromatic substances, modification of the property of coagulating, of the fat content etc.

Influences of fermentative nature, which are of two kinds, direct and indirect. The former are exerted when fragments of the food under discussion get into the milk and transmit to it noxious ferments; the latter when the milk gets contaminated through particles of faecal matter or by alterations of the blood plasm, both of which predispose the milk to injurious fermentations.

Industrial by-products, as all forage in general, always influence, within certain limits, the proportion between the various components of milk, even when they are very rich in water or possessing recognized galactopoetic properties. Among the constituents of milk only two, namely fat and casein undergo some variation.

This observation has been verified on all hands and it has been authoritatively confirmed by the classical work of Prof. Orla Jensen, who by a series of minute and patient experiments has arrived at the conclusion that the food supplied to milch cows does not produce appreciable variations in the composition of their milk.

This statement appears to be in glaring contrast with the practical observation which points to a certain connection between the nature of the food and the characters of the milk.

The contradiction, however, is only apparent, because from the practical point of view that connection is meant to refer not so much to the percentage of the components as to the goodness of the milk considered in its intrinsic qualities of odour, and pleasing taste, as perceived by our senses, by the digestive organs of infants which, as Porcher acutely obseves, are a more delicate test than the most sensitive chemical method of analysis because they reveal the presence in milk of properties and qualities that pass unnoticed by the chemist.

In this connection it is enough to recall the rapidity with which diarrhoea attacks children nourished with milk yielded by cows fed on fresh turnip leaves; the high rate of mortality, up to 54 per cent., in babies at Ingolstadt because the cows are fed to a great extent with the by-products of the numerous breweries of the town, the chronic gastro-enteritis observed by Tallemer at Saint-Just en Chaussée due to the milk of cows fed on the residues of sugar refining.

If these examples lead to the conclusion that the use of industrial by-products is to be condemned in the production of milk for infants, that is from the hygienic point of view, the same may be said from the technical standpoint as regards cheese-making, and this in accordance with the most recent scientific views, which consider the alterations and diseases of milk to be due, not so much to the action of specific micro-organisms as to the special condition of the milk plasm, which Peter defines as "fermentative predisposition of milk," an expression that is admitted and endorsed by Burri and by Barthel.

The predisposition to become the field of activity of one rather than of another ferment or which renders it unsuitable for cheese-making appears to be due to some alteration in the milk as a chemical medium.

The question of the use of beet root pulp as food for milch cows, which has been raised in Italy, as it had been for some time in other countries, in consequence of the establishment of sugar mills has met with many supporters and but few opponents. Nevertheless even the former have ended by recognizing that the continued and excessive use of beet pulp as had been practised in some provinces of Romagna, Lombardy and Venetia leads to the exhaustion of the animals, impoverishing the tissue of their bones and producing the disease known as osteomalacia.

These results led to a more moderate use of the pulp. The falling off in the condition of the cattle ceased to be perceptible to the breeder to whom beetroot pulp under any form is qnite familiar. But all those engaged in cheese dairying are hostile to their use, because they find the difficulties they have to contend with in their industry much increased by the milk yielded by cows fed on pulp. In some milk producing centres the practice of feeding beet pulp to milch cows has been given up. The regulations of the Soresina co-operative dairy forbid their use altogether.

The inconveniences noticed in cheese-making attendant on the use of fresh pulp and still worse, ensilaged pulp, have been for some time past attributed to certain gas producing milk ferments which live in great numbers on the pulp and eventually find their way into the milk, in which they set up a gas-producing fermentation and cause sourness with extraordinary rapidity. The problem has at last aroused interest in the sugar factories which have decided to put on the market properly dried and sterilised pulps. But not even the suppression of moisture and of the

air-producing germs have revealed themselves completely efficient, because they do not suppress the drawbacks of a chemical nature which even the dried pulps possess and which through the cow are transmitted to the milk. The dry pulps were experimented on a large scale by the travelling agricultural lectureship of Parma but with no satisfactory results, for, at the Gattatico dairy the manufacture of grana (Parmesan) had become impossible. In the course of working, in spite of the whey being sufficiently acid, the clots of casein remained loose like grains of sand so that when the cheese was taken out a quantity of casein remained in the whey.

Wishing to investigate further this anomaly, which the writer had personally observed, he continued the experiment at the Royal School of Zootechny and Cheese-making at Reggio Emilia. A detailed report on this experiment, has for various reasons not yet been published, but it is confirmed that the anomalies observed at the Gattatico dairy reappeared, though in a somewhat lesser degree, at the above school. They were discovered to be of a chemical rather than a fermentative nature and dependant upon a change in the ratios between lime, casein and lactic acid which are all important in the manufacture of " grana " cheese.

When these ratios change, either through a smaller quantity of lime combining with the casein, or through an insufficient formation of calcium lactate the required characters of plasticity and coherence of the curd are not attained, as these are especially due to this latter salt which acts so intimately on the particles of casein as to form presumibly a complex calcium lacto-caseinate.

These results show that dried beet pulps have a double action on milk: they communicate to it a fermentative predisposition which however is not of very great importance, and they alter its chemical structure in such a way as to hinder the formation of a proper curd.

The addition, as a corrective, of calcium lactate deserves consideration also from other points of view because it confirms the important action that the amount of lactic acid both free and combined exerts on the whole process of cheese making and that therefore the so-called degree of fermentation acidity that the writer has defined and indicated with precision in his investigations on the grana cheese of Reggio is and remains the firm and scientific basis of the technique of this cheese.

Summarizing the above, it may be stated that industrial by-products tend to alter the qualities and properties of milk more than its composition ; that cereal offals when they have been well kept may be freely used for milch cattle ; that among oil cakes those that do not cause noticeable alterations in the milk, such as linseed, maize and sesamum are to be preferred, provided they be used in moderate doses ; that the residues of fermentation industries and of sugar factories, under any form, are to be regarded with suspicion in connection with milk to be employed as

food for infants or in the cheese dairy, and that it would be beneficial to all to advise against feeding them to milch-cows. Besides, this prohibition should be introduced into the contracts between producers and dairies.

Lastly it is desirable that the public should be informed by means of the press and by lectures of the ease with which the best properties of milk may change under the action of certain feeds.

1649 – Feeding Experiments with Potato Pulp and Aniseed Offal.

HANSSON, NILS. Utfodringsforsok med potatispulpa och anisaffall. Meddelande Nr. 62 fran Centralanstalten for forsöksväsendet pa jordbruksomradet. Husdjursafdelningen Nr. 8 *Kunl Landtbruks-Akademiens Handlingar och Tidskrift.* Year 1912, No. 6, pp 385-403 Stockholm 1912.

On the basis of feeding experiments conducted by the writer on milch-cows and on pigs, he comes to the following conclusions:

1. Potato pulp (residuum of starch manufacture) treated with steam, if given in a mixture sufficiently rich in proteids) proved to be a good food for pigs and for milch-cows.

As the pulp contains very variable quantities of water it must be valued according to its content of dry matter, which in the fresh pulp averages from 7 to 7.5 per cent. but varies from 4 to 10 per cent. and even more in the case of preserved pulp.

2. In the feeding experiments in which the pulp was compared with beet root slices and with these slices treated with molasses, 2.46 to 2.55 lb. of the dry pulp corresponded to one food unit (1).

3. In the pig feeding experiments in which the pulp was compared with wheat and cooked potatoes, 1.05 to 1.06 lb. of dry matter of the pulp proved equal to 1 lb. of cereals.

4. The coefficient for reducing potato pulp to food units and for finding the quantity equivalent to 1 lb. of cereals may be calculated as follows:

Percentage of dry matter in pulp	Coefficient of reduction	
	to 1 food unit	to 1 lb. of cereals
5 per cent.	50.6 lb.	21 lb.
6 »	41.8 »	17.5 »
7 »	35.2 »	15 »
8 »	30.8 »	13 »
9 »	27.5 »	11.5 »
10 »	25.3 »	10.5 »

(1) The food unit in Sweden consists of 2.2 lb. of wheat, rye, barley or peas, vetches etc.

5. The feeding experiments with aniseed offal have shown that this food compared with equal quantities of cereals, has a less favourable influence on the quantity of milk, but it increased the fat content of the milk and the production of fat. It was also beneficial to the increase of the animals' live weight. Until more exhaustive experiments are made the value of this food may be calculated on its starch value, comparing this with cereals. 2.2 lbs. of anise seed offal corresponds thus to one food unit.

The high proportion of fat and of aromatic substances in aniseeds render it necessary to be careful in using them as food, and, pending further experiments, not more than 2.2 or 3.3 lb. should be fed to a head of large cattle per diem.

1650 – The Valuation of Phosphates of Lime used with Food for Live Stock.

Beurteilung von Futterkalk. Mitteilung des Verbandes der landwirtschaftlichen Versuchsstationen in Oesterreich, Nr. 8. *Zeitschrift für das landwirtschaftliche Versuchswesen in Oesterreich.* Year XIV, Part 10, pp 1189-1191. Vienna, 1912.

The phosphate of lime used as an addition to food for live stock is usually put on the market under the three following forms: precipitated acid phosphate of lime, degelatinized bone meal and bone ash; sometimes also, but not so frequently, as finely ground mineral phosphate.

The value of these products depends upon their assimilability. According to the exhaustive experiments of Köhler, the digestibility of bicalcic phosphate is 54 per cent. of the phosphoric acid, and 56 per cent. of the lime; in degelatinized bone meal it is only 13 per cent. of the phosphoric acid and 22 per cent.of the lime, while in bone ash the figures are respectively 14 and 18 per cent. Therefore if only digestibility be considered precipated acid phosphate of lime which consists chiefly of bicalcic phosphate would be four times as valuable as degelatinized bone meal or bone ash; but in reality it is worth still more because of the injurious effects of the other and useless substances the bone phosphates contain; only this greater value is difficult to express in figures. In trade no heed is paid to this difference in value, the prices of the three forms being about the same. The more honest traders do not consider these less valuable phosphates as complementary foods, and the agricultural experiment stations are of the same opinion. The resolution voted by the Union of the German agricultural experiment stations and adopted also by the Austrian experiment stations says: In consequence of the development of the trade and use of such complementary foods, under the name bone meal food (Knochenfuttermehl or Futterknochenmehl) the farmer designates only precipated phosphate of lime which consists chiefly of bicalcic phosphate and not of any kind of bone meal (crude steamed bone meal, degelatinized and calcinated) which is found in trade and used as a manure.

As a means of distinguishing these phosphates from each other, their solubility in citrate of ammonia is used. In precipated phosphate at least 80 per cent. of the total phosphoric acid is soluble, while in bone meal only 10 per cent, dissolves, and often only traces of citrate soluble phosphoric acid are found in some preparations of bone ash.

As dicalcic phosphate food only precipitated phosphate of lime having a high degree of citrate - solubility must be considered, and all other preparations must be named and valued as inferior substitutes.

In trade a so-called vegetable phosphate of lime food (vegetablischer Futterkalk) is met with. It consists mostly of phosphate of lime ot its inferior substitutes mixed with more or less vegetable matter, chiefly aromatic ; and usually containing seeds of fenugreek. In valuing such products the price must always be considered ; in this case the vegetable constituents are valueless as food.

What has been said above holds good not only for the phosphates of lime as such, but also for their mixtures with other foods under the form of artificial or complex foods for live stock.

In valuing all these foods their water content, which must not exceed 10 per cent. must also be considered, as well as the injurious impurities that they might eventually contain, such as arsenites, sulphides, and fluorine compounds, in which case they should not be considered marketable. Chlorides may be tolerated up to 1 per cent. calculated as calcium chloride, and substances insoluble in hydrochloric acid under 3 per cent.

1651 - The Theory of the Determination of Sex. BREEDING

EMERY, C. Sulla teoria della determinazione dei sessi. — *Atti della Reale Accademia dei Lincei*, Year CCCIX, Fifth Series, Vol. XXI, Part 7, pp. 397-400. Rome, October 13, 1912.

Recent studies on spermatogenesis have shown that in many animals sperm cells of two kinds are formed and that these are very probably if not certainly connected. (See HERTWIG, RICHARD; Ueber den derzeitigen Stand des Sexualitäts-problems nebst eigenen Untersuchungen. — *Biologisches Centralblatt*, Vol. 32, Nos 1-3: 1912). The sperm cells are usually of two kinds: those provided with heterochromosomes or sexual chromosomes, and those without them. They are derived from the unequal division of the diploid nucleus of one spermatocyte into two aploid nuclei of spermatidia. But in some insects the spermatocyte divides into two spermatidia having an equal number of chromosomes and of which the autochromosomes are homologous, but the heterochromosome is not equivalent. If the heterochromosome of the ovum be indicated by the symbol x, the heterochromosomes of the sperm cells will be designated by x and y (the heterochromosome x being considered identical

with the heterochromosome of the ovum) and the sperm cell provided with the chromosome x will be the determinant of the female sex of the fertilized ovum. Now the existence of the chromosome y, which usually is considered as the determinant of the male sex, renders the problem obscure. The writer attempts to simplify it by advancing the hypothesis that it is connected with the exterior accessory characters, or, as Hertwig expresses it, " concordant " with the male sex and not determining it. Similarly it is litkely that the determinants of the characters concordant with the female sex are sometimes united with the chromosome x.

Setting the chromosome y aside, the formula of the chromosomes of the male becomes equivalent to the formula of the female, minus the chromosome x; indicating by A the complexity of autochromosomes, the following are obtained :

for the female fecundated ovum : $(A + x)$ $(A + x)$
,, ,, male ,, ,, : $(A + x)$ $(A + 0)$

Thus the two sorts of sperm cells, those of female character $(A+x)$ and those of male character $(A+0)$ would be, ***under normal conditions***, the factors of the determination of sex. This reserve is made because there may be exceptional conditions which modify this result.

Some Mendelists say that in the determination of sex the male is heterozygous, and the female homozygous, and that the male character is dominant over the female. It is to be noted that the female is distinguished by a positive determinant; While the male is distinguished by the weakness of that determinant, which is absent in the male sperm cell.

Prof. Achille Russo has shown that by means of the injection of lecithin in female rabbits a recessive character (white coat colour as against the dominant black coat) may become dominant, the conditions of nutrition of the ovum being changed. In other words, under the improved conditions of nutrition of the ovum, the female character has become dominant and has partially resisted the influence of the sperm cells of male character.

Similarly, R. Hertwig has ascertained that premature or over-mature ova of frogs (that is ova in unfavourable conditions of nutrition) have given a progeny chiefly or exclusively consisting of males. It would thus appear that masculinity is only the negation of feminility ; on the other hand it seems difficult to admit that a negative character, which in other words has no favourable determinant, should be dominant over a positive character. The writer supposes therefore that a determinant of masculinity really exists and he represents it by the symbol ξ. It is necessary that this determinant should be always ready to act when the leading influence of the female determinant or x is insufficient ; the writer therefore presumes that it is not to be sought for among the heterochromosomes,

but that it is an element constantly present in the ova and in the sperm cells. According to his hypothesis, and adopting Mendelian language, the male would be equally heterozygous and the female homozygous; the following would then be the normal formula:

for the female-producing fecundated ovum: $(A\ \xi + x)\ (A\ \xi + x)$
„ „ male-producing „ „ : $(A\ \xi + x)\ (A\ \xi + o)$.

But x, the female determinant, might be sometimes dominant, sometimes recessive according to circumstances, that determinant being heightened or depressed; the formula ould then be:

for the female-producing fecundated ovum: $(A\ \xi + X)\ (A\ \xi + o)$
„ „ male-producing „ „ : $(A\ \xi + x)\ (A\ \xi + x)$

putting X for the heightened female determinant (that is to say dominant); x for the depressed female determinant (that is, more than usually recessive).

1652 – In-breeding Experiments on a German Sheep Farm.

SCHMEHL, R. Inzuchtstudien in einer deutschen Stammschäferei.—*Arbeiten der Deutschen Gesellschaft für Züchtungskunde*, No. 15. Hanover, 1912.

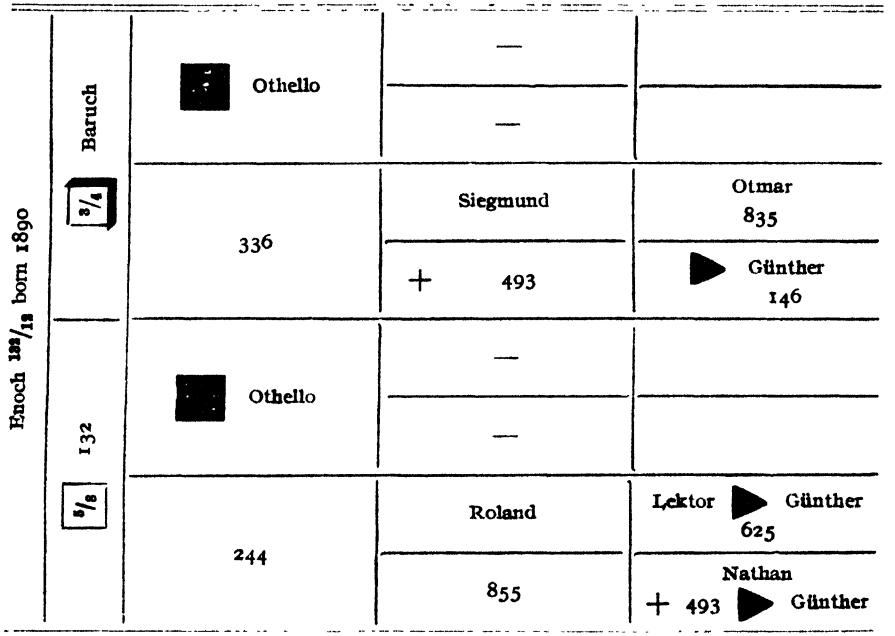
The writer gives in his introduction a short review of the theories which have been brought forward during the second half of the 19th century by the German teachers of the science of breeding. He shows, for example, how von Weckherlin was a special advocate of inbreeding, while Settegast arose as an energetic opponent of the former's views and maintained that inbreeding was injurious, and to be avoided at all costs.

Lately, however, Settegast's theory has been overthrown. The investigations on the subject of heredity, carried out by Bruce Lowe and Walsh led other workers in Germany to study inbreeding; first, Graf Lehndorff and subsequently, Hoesch and de Chapeaurouge turned their attention to this subject. These writers found, as a result of their extensive studies, that inbreeding had played a very important part in very many successful breeding experiments and that the judicious use of in-breeding is not to be condemned, but rather to be aimed at.

The writer of the above-mentioned work has been engaged in investigations on the subject of the in-breeding of sheep. He prosecuted his researches at the Zemlin Pedigree Sheep Farm, which possesses very well-kept Flock Books. By reference to the latter the descent was first ascertained of such pedigree animals as had either been prize winners at the shows of the German Agricultural Society, or whose performance in the flock had proved to be excellent. The pedigrees of these sheep are given in the paper, and the separate animals are more minutely described; 19

good plates of the best animals supplement the text. Such sheep as appear many times in a pedigree (showing inbreeding) have (according to the practice first adopted by Chapeaurouge) a special sign (square, cross, triangle, circle, etc.) added to their names, thus enabling the line of descent to be more easily seen. Often also, hollow symbols (hollow squares, etc.) are employed, in which the amount of "blood" possessed by the animal is denoted by a fraction. As an example we reproduce such a table.

*Pedigree of Ram Enoch *.*



* The upper half of the table contains the names or numbers of the ancestors of Enoch's sire, the lower, the names or numbers of the ancestors of his dam; all sires are entered by name and all dams under their Flock book number. In the last lower vertical division, Günther is further given as the sire of the ram Lektor and the sheep No. 493. This is done to save space: strictly speaking, another space to the right should have been reserved for Günther.

The result of the inspection of the Zemlin herd proved that all the best breeding animals were the products of inbreeding; a moderate degree of inbreeding was practised, as a rule, but some of the best sheep were closely inbred. The writer draws attention to the fact, however, that some of the inbred animals were in no wise superior to the average of the flock.

This is a warning to the breeder: objectless inbreeding does not lead to success, but only in-breeding where the breeder each time carefully

selects and pairs suitable animals. Lasting success can be attained in this manner, however, only when the breeding sheep are kept in natural conditions.

1653 - The Composition of the Milk of Some Breeds of Indian Cows and Buffaloes and its Variations. CATTLE

MEGGITT, A. A. and MANN, HAROLD, H.: *Memoirs of the Department of Agriculture in India, Chemical Series*, Vol. II, Nos. 1 and 4; pp. 1-61 and 195-258. Calcutta-London; July and August, 1912.

The data in existence with regard to the composition of the milk of Indian cows and buffaloes are extremely incomplete, and little if any can be found as to the relationship between the yield of milk obtained and its composition. There are practically no reliable analyses to be had apart from a series published by Dr. Leather in 1901. (*Analyst*, Vol. XXVI, p. 40).

He concluded that Indian cows' milk differs in no essential particulars from that met with in Europe. The relation existing between the specific gravity, the solids-not-fat, and the fat agree well with those of milks from English cows. So also the relationship between the milk sugar, the proteids, and the mineral matter agrees well with the proportions 13 : 9 : 2. The percentage of butter-fat is high, varying from 4 to 6. The colour of the milk is very nearly white, that of the butter is very pale yellow. The majority of the samples of buffaloes' milk are characterized by an extraordinarly high proportion of butter-fat, 7 and 8 per cent. being common, and in one case close on 10 per cent. of fat was found. Buffaloes' milk is white and the butter also usually is quite white. The relation existing between the specifie gravity, the solids-not-fat, and the fat is the same as for cows' milk, the solids-not-fat, when calculated by Richmond's formula, agreeing well with those found by analysis. The percentage of proteids is higher than in cows' milk, and varies from 3.5 to 4.3 per cent. The percentages of milk-sugar and mineral matter correspond very closely with those of cows' milk; on the other hand, the relationship between these ingredients is not the same and works out to about 10 : 12 : 2.

The writers have found that the formulae calculated by Richmond for the milk of the Egyptian buffalo or « gamoose » (*Journal of the Chemical Society*, 1890 Trans. p. 754; see also: RICHMOND, *Dairy Chemistry*, C. Griffin e Co). are applicable very closely to the milk of both Indian cows and buffaloes and have adopted this method throughout. These formulae are:

$$T = 0.27 - \frac{G}{D} - 1.191\,F;$$

$$\text{and } \frac{G}{D} = -0.761\,F - 4\,L - 2.5714\,P - 7.5715\,A;$$

T — Percentage of Total Solids.
G — Lactometer degrees, as read at 15.5° C.
D — Specific Gravity at 15.5°C
F — Percentage of Fat.
L — Percentage of Milk Sugar.
P — Percentage of Proteids.
A — Percentage of Mineral Matter.

The fat has always been determined by the Gerber method ; the specific gravity has been taken in the fresh milk, cooled, by the lactometer and the results calculated to 15.5° C.. Where the milk had to be kept for a few hours for the fat determination, it was preserved by means of potassium bichromate.

The object in view in the writers' investigations has been to ascertain, with regard to Indian cows and buffaloes, how the yield and composition of milk were related to one another, and how each was influenced by season, by weather conditions, by period of lactation, food, age, etc. The present paper is intended only as a preliminary one.

I. — *The Milk of Indian Cows.* The cow's milk examined came from animals belonging to the herd at the Poona (Bombay) Civil Dairy, principally composed of animals of the Gir and Sind breeds.

A number of detailed tables show the average composition of the milk from herds of cows of both the Gir and the Sind breeds ; the average composition when the yield varied between certain limits in the case of each animal ; the length of the lactation of 8 Gir cows and that of 12 Sind cows for every calving during 1906 to 1909 ; the individual yield and the fat percentage for every tenth of the whole milking period ; etc. We limit ourselves to reproducing some of the more important figures and the summary of conclusions.

TABLE I. — *Average Percentages of Fat in the Mixed Milk of Cows of the Poona Dairy Herd.*

DATE		Number of Samples	Percentage of Fat	
			Morning Milk	Evening Milk
January	1908	6	3.98	5 30
February	»	19	4.10	5.20
March	»	22	4.34	5.30
April	»	15	4.50	5.40
May	»	18	4.40	5 20
June	»	13	4.20	5.20
July	»	5	4.50	4.90
August	»	5	5.00	5.90
September	»	10	5.00	5.10
October	»	12	4.50	5.10
November	»	7	4.90	5.60
December	»	12	4.80	5.85
January	1909	12	4.50	5.77 *
Average		156		

* Nine samples only.

TABLE II. — *Analyses of Mixed Milk of Indian Cows.* *

	Sept. 26 1907	Oct. 3 1907	Oct. 10 1907	Oct. 17 1907	Oct. 24 1907	Nov. 7 1907	Nov. 14 1907
	%	%	%	%	%	%	%
Water	84.98	85.06	85.80	85.45	85.44	85.39	84.81
Fat	5.80	5.75	5.30	5 75	5.50	5.80	5.80
Proteids	3.54	3.56	3.60	3.60	3.54	3.55	3.80
Milk-Sugar	4.92	4.87	4.53	4.41	4.74	4.52	4.83
Ash	0.76	0.76	0.77	0.79	0.78	0.74	0.76
	100.00	100.00	100.00	100.00	100.00	100.00	100.00
Total solids	15.02	14.94	14.20	14.55	14.56	14.61	15.19
Total solids not fat	9 22	9.19	8.90	8.80	9.06	8.81	9.39
Sp. Gravity at 60°F	1.030	—	1.030	1.029	1.030	1.0295	—

* The analysed milks very fairly represent the class of milk which should be turned out by an Indian dairy composed of cows alone.

1. In a mixed herd of cows of the Gir and of the Sind, the composition of the milk may be considered to be fairly constant. The morning milk will contain between four and five per cent. of fat, and the evening milk between five and six per cent. Under the conditions of the Poona dairy farm, where green fodder is grown and fed throughout the year, there will not usually be a very marked drop during the rains. (July to October). The richest milk, taking the whole herd into consideration, is reached in the latter part of the rains.

2. The evening milk is nearly always richer than the morning milk. This difference is, however, less marked in the raimy season than during the remainder of the year.

3. Of the two breeds studied, the Gir gives milk of decidely poorer fat content than the Sind, the average figures being :

	Morning Milk	Evening Milk
Gir cows	5 2 per cent	6.2 per cent
Sind cows	6.0 per cent.	6.3 per cent

4. There seems little relationship between the composition of the milk of individual cows and the yield, except that the milk becomes slightly richer at the end of the period of lactation. Apart from this, the milk yielded by a cow is wonderfully constant in composition whatever the amount of yield it is giving.

5. On the other hand , there is a very great variation in the composition of the milk of the animals of one breed. This is what sould be expected in breeds of cows which have undergone no selection for many generations.

6. The average length of lactation for Gir cows, is 40.5 weeks, (from 30 to 54 weeks) and for Sind cows is 50.8 weeks, (from 27 to 61 weeks) but this varies very much, as would again be expected for unselected cows.

7. The yield of milk from a cow rises to its maximum almost at once, and remains almost constant for about the first two-fifths of the lactation period. After this there is a regular and steady decline to the end of the lactation (See table III).

Table III. — *Yields of Milk of Indian cows in successive lactation periods.*

	General average yield for 8 Gir cows	for 12 Sind cows.
First tenth of the milking period	299 1/4 lbs	415 1/4 lbs
Second ,, ,, ,, ,, ...	337 3/4 ,,	410 3/4 ,,
Third ,, ,, ,, ,, ...	360 3/4 ,,	454 ,,
Fourth ,, ,, ,, ,, ...	353 1/2 ,,	434 3/4 ,,
Fifth ,, ,, ,, ,, ...	318 1/4 ,,	388 ,,
Sixth ,, ,, ,, ,, ...	276 ,,	333 1/2 ,,
Seventh ,, ,, ,, ,, ...	238 ,,	299 ,,
Eighth ,, ,, ,, ,, ...	203 ,,	257 ,,
Ninth ,, ,, ,, ,, ...	146 3/4 ,,	205 ,,
Tenth ,, ,, ,, ,, ...	79 ,,	137 1/2 ,,

8. Among Sind cows there is a tendency for the milk to become richer in fat as the lactation progresses. It seems more obvious in the case of the morning than with the evening milk and usually becomes very marked in the last stage of the lactation. Among Gir cows the rise is not nearly so constantly found.

9. One of the most marked results of the whole investigation is to emphasize the extremely unselected character of herds of even recognised milking breeds like the Gir and Sind, in India. The dominance of the individuality of the cows almost renders the environmental influences on the composition of the milk yielded incapable of being detected.

II. *The Milk of Indian Buffaloes.* — The investigations and the analyses were made by the same methods as those adopted in connection with investigations on the milk of Indian cows. The present investigations were carried ont during a period of fifteen months on 24 buffalo cows (18 of the « Surti » breed, 1 of the Jaffarabadi breed, 2 of the Delhi breed, and 3 of the Deccani breed) contained in the herd at the Poona Civil Dairy.

The average fat percentage of the milk of the whole herd at different months is reproduced in table IV; some complete analyses of the same mixed milk are reproduced in table V.

TABLE IV. — *Average fat percentages of mixed Milk of Buffaloes, at different months.*

Date	Number of Samples	Percentage of fat	
		Morning Milk	Evening Milk
January 1908 . . .	6	6.6	8.0
February » . . .	19	6.9	8.4
March » . . .	21	6.9	8.0 (average of 20 samples only)
April « . . .	16	7.0	7.4 (» 17 »)
May » . . .	17	7.5	8.0
June » . . .	13	6.7	7.8
July » . . .	6	7.0	8.1 (» 4 »)
August » . . .	4	7.2	7.5 (» 3 »)
September » . . .	10	6.7	7.5 (» 8 »)
October » . . .	12	7.0	7.6 (» 10 »)
November » . . .	7	7.9	8.3
December » . . .	12	7.4	8.0
January 1909 . . .	12	7.2	8.2 (» 9 »)
Average . . .		7.06	7.92 (average of 145 samples)

TABLE V. — *Analyses of Mixed Milk of Indian Buffaloes* (1907).

	Sept. 26 %	Oct. 3 %	Oct. 10 %	Oct. 17 %	Oct. 24 %	Nov. 7 %	Nov. 14 %
Water	81.51	82.21	82.10	81.72	81.94	81.19	81.43
Fat	8.05	7.60	8.00	8.15	7.90	8.70	8.40
Proteids	4.33	4.27	4.31	4.35	4.30	4.37	4.36
Milk Sugar	5.28	5.09	4.74	4.97	5.03	4.91	5.02
Ash	0.83	0.83	0.85	0.81	0.83	0.83	0.79
	100.00	100.00	100.00	100.00	100.00	100.00	100.00
Total Solids	18.49	17.79	17.90	18.28	18.06	18.81	18.57
Solids-not-fat . . .	10.44	10.19	9.90	10.13	10.16	10.11	10.17
Specific Gravity at 60° F.	1.0316	—	1.031	1.0315	1.0315	1.0315	—

These analyses show, in confirmation of all previous results, how very rich in fat and other valuable constituents is the milk of the Indian buffalo and how extremely constant remains the milk of a mixed herd.

A number of other detailed tables are given and discussed in the paper under review; we limit ourselves to reproducing the summary of conclusions.

1. In a mixed herd of buffalo cows, in Western India, and composed of animals of the Surti, Delhi, Deccani and Jaffarabadi breeds — the number of cows of any one breed naturally varying from time to time, but with the Surti generally predominating, the composition of the milk may be considered as fairly constant. The morning milk will contain

between 6 ½ and 8 per cent. of fat, and the evening milk between 7 ½ and 8 ½ per cent. of fat. Under the conditions of the Poona Dairy Farm, where green fodder is grown and fed throughout the year, there will not be a *very large* drop in fat content in the rains, though such a drop is obvious, more especially in the evening milk. Taking the three seasons, typically found in the Poona climate, the percentage of fat in mixed milks is found to vary as follows :

	Morning milk Percentage of fat	Evening milk Percentage of fat
Cold weather (November-February)	7,16	8.22
Hot weather (March-May)	6,94	7,81
Rains (June-October)	6,86	7.66

2. As with cows, the mixed evening milk is always richer than the mixed morning milk, the difference in fat content being from 0.3 to as much as 1.5 per cent. The "solids-not-fat" in the morning and evening milks are substantially identical in amount.

3. The average composition of mixed buffalo milk of the breeds at the Poona Dairy shows a fat content as follows :

Morning milk . . . 7.1 per cent
Evening milk . . . 7.9 „ „

The solids other than fat are present in a ratio very closely approximating to:

Milk sugar : Proteids : Ash :: 6 : 5 : 1.

The proteids are slightly in excess of this ratio.

The milk of the Surti breed is richer than the above figures for mixed milks and the fat content gives average figures as follows :

Morning milk . . . 8.3 per cent
Evening milk . . . 8.5 „ „

4. The percentage of solids-not-fat in the milk from Surti buffaloes varies between 9.5 and 11.5 per cent., for almost all the samples. For about three-quarters of the samples, whether of morning or evening milk, the percentage lies between 10.0 and 11.0 per cent.

5. There seems little relationship between the composition of milk of individual animals of the Surti breed and the yield, except that the milk becomes *slightly* richer at the extreme end of the period of lactation. Apart from this, the milk yielded by a single buffalo does not seem to vary according to the amount of milk it is giving.

6. There is a very great variation in the composition of the milk of individual animals of one breed, and also of that of the same buffalo at

various times. This last variation in the quality yielded by one animal is much greater that previously found for Indian cows. The variation on the content of solids-not-fat with one animal is practically as wide as for the whole of the animals examined.

7. The average length of lactation for the Surti buffaloes is 53 weeks, but this varies very much, from 32 weeks to 67 weeks.

8. The yield of milk from a buffalo during the lactation rises to a maximum almost at once, and remains almost constant for about the first two-fifths of the lactation period. After this there is a regular and steady decline to the end of the lactation.

Table VI. — *Yields of Milk of Surti Buffaloes in successive periods of Lactation* *

	Geueral average of 17 buffaloes
First tenth of the milking period	374 lbs.
2nd " " " " "	491 3/4 "
3rd " " " " "	483 1/4 "
4th " " " " "	438 1/2 "
5th " " " " "	393 1/2 "
6th " " " " "	351 "
7th " " " " "	311 "
8th " " " " "	270 "
9th " " " " "	227 3/4 "
10th " " " " "	143 3/4 "

* These figures are somewhat smaller than in reality; they represent only the quantity of milk obtained by milking after the young buffalo has taken the smallest quantity possible, because Indian buffalo cows do not allow themselves to be milked until they have suckled their young.

9. There is no relationship between the composition of the milk given by a buffalo and the period of the lactation except when the animal is rapidly becoming dry.

1654 – Fattening Calves in Alabama.

GRAY, DAN T. and WARD, W. F.: *U. S. Department of Agriculture, Bureau of Animal Industry*, Bulletin 147, 40 pp. + 3 plates. Washington, 1912.

The Bureau of Animal Industry of the U. S. Department of Agriculture, working in cooperation with the Alabama Experiment Station, has done several years' experimental work in fattening mature steers for the market. Excellent profits were realized on these cattle. Since the publication of the results (in *Bureau of Animal Industry Bulletins* 103 and 131 and *Alabama Experiment Station Bulletins* 150 and 151) many farmers in the South have raised the question "Why not fatten the animals

while they are young ? " Many points can be urged in favor of the system of fattening the calves so as to dispose of them by the time they are a year old : more breeding animals can be kept upon the farm ; the younger the animal, the cheaper each pound of beef is made ; the money invested is turned more rapidly.

In order that they might be in a position to assist in aswering such inquiries, the authorities of the Bureau of Animal Industry and the Alabama Experiment Station undertook three experiments in fattening calves, which are hereafter described. The details are divided into three parts. In part I the calves were fattened, during their first winter, on cottonseed meal and hulls, corn-and-cob meal, and alfalfa hay ; in part II similar winter fattening was carried on with cottonseed meal and hulls and pea vine (pea haulm) hay, and in part III the calves were fed in the winter and fattened during the following pasture season.

Part I. — The calves used in this work were high-grade animals, although not purebred. They were grade Shorthorns, Aberdeen - Angus, Herefords, and Red Polls. They were from 6 to 8 months of age when the fattening experiment began. During the preceeding summer they had run with their mothers on good pasture.

The daily ration for each calf for the experimental period from November 17, 1910, to March 17, 1911 ; the weights, total gains, and average daily gains ; the quantity and cost of feed required to 100 lbs. of gain ; the prices realized on each feed when fed to the calves and prices of other feeds ; the financial statement, and slaughter data are given in tables and discussed. The summary statement of the first experiment is shown on the opposite page.

Part II. — The main objects of the second experiment were : 1).To determine whether or not young beef calves can be fattened profitably for the spring market on a feed of cottonseed meal, cottonseed hulls, and mixed pea-vine hay ; 2) to study the value of shelter for young calves while being fattened. Fifty-two calves were used in this experiment, being partly grade Aberdeen Angus, partly of common quality, and 6 to 8 months old when the test began. They were divided in two lots ; one lot was fed under the shelter of a good barn, the other lot being fed in a corn-stalk field with no shelter at all except some tress. It was subsequently seen, however, that these young calves would not thrive during the winter months without a shelter to keep off the cold rains ; so on February 11, 1911, they were brought into the barns and placed under the sheds with the other calves. After February 11 the 52 head of calves were fed as one lot. On account of this fact, the test is presented as one lot.

Prices and quality of feeds ; daily ration for each calf, by monthly periods, from Dec. 7, 1910, to March 29, 1911 ; weights and gains for total feeding period of 112 days ;quantity and cost of feed required to make

Experiment I.

Item	Lot 1	Lot 2	Lot 3
Calves in each lot	27	24	26
Rations	Cottonseed meal. Cottonseed hulls. Mixed alfalfa hay * —	Cottonseed meal, two-thirds. Corn-and-cob meal, one-third. Cottonseed hulls. Mixed alfalfa hay.	Cottonseed meal, one-third. Corn-and-cob meal, two-thirds. Cottonseed hulls. Mixed alfalfa hay
Total days fed	119	119	119
Average weight when feeding began	338 lbs.	333 lbs.	328 lbs.
Average final weight	541 »	543 »	546 »
Average gain of each calf	203 »	210 »	218 »
Average daily gain of each calf	1.71 »	1,76 »	1.83 »
Pounds feed to make 100 lbs gain	179 lbs. meal 435 lbs. hulls 315 lbs. hay —	133 lbs. meal 65 lbs. corn 425 lbs. hulls 310 lbs. hay	130 lbs. meal. 211 lbs. corn. 400 lbs. hulls. 218 lbs. hay
Cost to make 100 lbs gain	$ 6.22	$ 6.19	$ 6.83
Price realized on each ton of cottonseed meal when other prices are fixed	» 36.10	» 42.18	» 36.50
Price realized on each ton of hulls when other prices are fixed	» 11.15	» 12.05	» 10.40
Price realized on each bushel of corn when other prices are fixed	—	» 1.90	» 0.95
Price realized on each ton of hay when other prices are fixed	» 20.72	» 20.92	» 21,25
Fall price of calves per cwt.	» 3.50	» 3.50	» 3.50
Selling price of calves per cwt.	» 5.01	» 5.11	» 5,26
Profit on each calf above all expenses	» 1.84	» 2,25	» 1.48

* Johnson grass and alfalfa in about equal parts.

100 lbs. of gain ; amount realized on each feed when prices of the other feeds are fixed ; financial statement ; slaughter data, are tabulated and discussed. The summary statement is as follows :

Total number of calves	52	
Average weight of each calf at beginning of test (Dec. 7, 1910)	313	lbs.
„ „ „ „ end „ (March 29, 1911)	452	„
„ gain „ „	139	„
„ daily gain of each calf for 112 days	1.24	„
Pounds feed required to make 100 lbs. of gain — meal	249	„
Pounds feed required to make 100 lbs. of gain — hulls	808	„
Pounds feed required to make 100 lbs. of gain — hay	121	„
Cost to make 100 lbs. of gain	$6.97	
Price realized on each ton cottonseed meal, prices of other feeds being fixed	$46.32	
„ „ „ „ „ hulls „ „ „	$13.24	
„ „ „ „ „ hay „ „ „	$56.61	
Value of calves at beginning of test (Dec. 7, 1910) : per cwt.	$3.00	
Selling price of calves at New Orleans (March 29, 1911) : per cwt.	$5.55	
Total profit on each calf	$3.50	

Part III. The calves in this experiment were born during the spring of 1909. During the summer of 1909 they were with their mothers on pasture. When fall arrived and the pastures were exhausted they were taken from their mothers, weaned, tagged, dehorned and the males castrated. They were then put up in an acre lot in which there was a good shed and no grass, and were fed all winter on a ration of cottonseed meal, corn chop, cottonseed hulls, and mixed alfalfa hay. The object was to give them sufficient feed to produce good gains all through the winter months, but not to fatten them for the market until the pasture was available in the following spring. By the latter part of March, 1910, sweet clover (*Melilotus*) had appeared, so the calves were changed from the winter feed to this pasture and fed some cottonseed cake and alfalfa hay in addition. They were kept upon this pasture until June 22, 1910, when they were sold. During the latter part of the grazing season there was some Japan clover (*Lespedeza*) and Bermuda in the pasture. During all this time the calves were given a small daily feed of cottonseed cake along with the pasture. The object of the work was to determine the profit, if any, in handling and feeding beef calves in accordance with the above plan. The 34 calves used in this test were a good grade, containing Aberdeen Angus, Hereford or Shorthorn blood. Salt was supplied regularly, also good pure water in clean troughs.

Characters and prices of feeds ; daily feed for each calf for the whole period (Dec. 3, 1909 to June 22, 1910) ; total and daily gains, average daily ration and quantity and cost of feed to make 100 lbs. of gain ; prices realized for feeds as a result of feeding to calves ; financial statement,

and slaughter records are tabulated and discussed. The summary statement is as follows:

Cost of calves fall of 1909	$3.50
Average weight of calves, Dec. 3, 1909	386 lbs.
Average daily ration from Dec. 3, 1909 to March 24, 1910:	
Cottonseed meal	1.68 „
Corn chop	1.39 „
Cottonseed hulls	8.49 „
Mixed alfalfa hay	3.77 „
Average weight of calves March 24, 1911	512 „
Average daily gain during the winter months	1.13 „
Cost to make 100 lbs. increase in live weight during the winter months	$8.63
Cost to feed each calf through the winter months	$10.90
Total cost of calves when put on pasture March 24, 1910: per cwt.	$4.79
Cost to make 100 lbs. increase in live weight on pasture	$4.84
Each ton of cottonseed cake was sold, prices of other feeds being fixed, by means of calves, for	$35.82
Each ton of alfalfa hay was sold, prices of other feeds being fixed, by means of calves, for	$21.48
Selling price of calves on farm, after 3 per cent shrink: per cwt.	$5.50
Profit on each calf	$1.86

This experimental work is being continued, but at the present time the following general conclusions, based on the work already done, can be drawn:

1. A farmer may expect to obtain a reasonable profit on beef calves when he raises and fattens them on his farm and sells them when they are 12 to 14 months old. That is, the farmer who feeds his corn and hay to these young animals can realize more on these raw farm products, when sold through the calves, than when sold as corn or hay. At the same time a large amount of manure is made on the farm to enrich the soil.

2. In the South, at least in Alabama at the present time, the calves should be born during the early spring months.

3. The southern feeder has the choice of many different feeds suitable for fattening calves. With reference to the feeds reported in this bulletin the following conclusions are warranted:

a) When fattening calves it pays to feed a ration made up of one-third corn-and-cob meal and two-thirds cottonseed meal, when corn is valued at 70 cents a bushel and meal at $26 a ton.

b) It is not profitable for two-thirds of the concentrated part of the ration to be composed of corn-and-cob meal when the feeds are valued as above.

c) Young calves can be finished for the market at a profit on cottonseed meal, cottonseed hulls, and pea-vine hay, but it is more profitable

to introduce corn-and-cob meal to take the place of part of the cotton-seed meal.

4. When shall the calves be sold ? The tests seem to indicate that it is more profitable to feed a heavy ration and sell the calves at the end of the winter months when prices are normally high, than to hold them until the early summer months. Light winter feeding produces expensive gains. Although the subsequent pasture gains are made much more cheaply than the winter gains, they are not made economically enough to overcome or counteract the preceding high-priced slowly-made winter gains, together with the normal depreciation in the value of cattle from March or April to June or July.

1655 - The Pasture for Pinzgau-Möllthal Bull-Calves at Hintereggen in Carinthia and its Economical Results. (1)

DORTA, J. H. Il pascolo pei torelli di razza Pinzgau-Möllthal a Hintereggen in Carinzia, e i risultati economici con esso ottenuti. — *Bollettino dell'Associazione Agraria Friulana*, Year 57, Series VII, Vol. 29. Udine, September 30, 1912.

The Pinzgau-Möllthal breed of cattle is, in Carinthia, the object of special care on the part of the Government and of the provincial administration, which generously subsidise those agricultural institutions that promote zootechnical improvement. Thus the Imperial and Royal Agricultural Society for Carinthia disposes of a yearly grant of 50 000 crowns (over £2 000) for the improvement of cattle. Recently the same Society was granted an extraordinary yearly subsidy of 120 000 crowns (£5 000) for five years.

In Carinthia there are now three cooperative pastures for bull-calves: Hintereggen, near Spittal, with 24 animals ; Manhard, near Obervellach, with 45 ; and Plöcken with 20.

The writer reports at length upon the pasture of Hintereggen which he visited recently on behalf of the Friuli Agricultural Association and through the courtesy of the Director of the Agricultural School of Litzlhof, Herr Pulfer, who accompanied him and supplied the information which is here briefly summarized. The data here given refer to 1910, namely the third year in which the pasture was grazed, and during which it was carefully examined by Herr Pulfer. The pasture of Hintereggen belongs to the Lurnfeld-Hachsenburg Cattle-breeders' Association. It is situated at 1000 m. (3300 ft.) above sea-level and is 37 acres in extent. With the exception of some few wet spots it yields excellent forage, which is now much improved thanks to appropriate phosphatic and potassic manuring, and to a well arranged system of grazing its various parts in rotation. It is divided, by wooden fencing, into five pastures, one of which

(1) See No. 1064, *B.* July 1912. (*Ed.*).

is usually mown. The cattle are allowed to graze in the evening after sunset or in the morning before sunrise. During the night they are left in the open so as to get hardier, and during the day they are protected against the heat in the stables in which they get hay in variable quantities and concentrateds in fixed quantities, namely 1 lb. of crushed oats and 1 lb. of bran per head.

Some data on the measurements and increase in weight made by the bull-calves on the Hintereggen pastures are given below, as well as the economical account of the same for the year 1910.

During the 127 days that the mountain grazing lasted the following average increase was recorded :

	Average increase
Weight	292 lb.
Height at withers	3.32 inches
Girth	7.85 „
Depth of chest	2.13 „
Breadth of chest	2.55 „
Width of hips	1.48 „
Length of body	4.23 „
Circumference of shin	0.60 „

The increase in weight was the following:

	Number of head	Days of mountain grazing	Increase in weight
	—	—	lbs.
Total	18	127	5202
Average total per head	—	127	292
Daily average per head	—	1	2.30

The least increase in weight was that made by calf No. 16, which gained only 110 lbs. in 127 days, or 0.86 lb. per diem. This is explained by the fact that he was for a long time suffering from sore feet and could not profit much from grazing. The greatest increase was made by calf No. 18, which gained 385 lbs. or 3.04 lb. per day.

1656 - **Experiments on Feeds for Wintering Pregnant Ewes** (1). SHEEP.

EVVARD, JOHN M. (Assistant Chief in Animal Husbandry). — *Communicated by the Iowa Experiment Station, Animal Husbandry Section.*

To compare the relative efficiency of corn silage and the standard leguminous hays for the wintering of pregnant ewes, the Iowa Experiment Station carried on in the winter of 1911-12 an extensive experiment.

(1) See No. 1323, *B.* Sept. 1912. (*Ed.*).

The objects of the experiment were to determine the relative influences in producing strong, thirifty, well-boned lambs of good size.

Forty-eight ewes were equally divided as to breeding, thrift, condition, shearing ability and weight into four lots as follows :

Lot 1	Clover hay and shelled corn.
Lot 2	Alfalfa hay and shelled corn.
Lot 3	Clover hay, corn silage and shelled corn.
Lot 4	Corn silage and shelled corn.

These ewes were all bred to the same ram, the breeding season beginning September 24 and ending November 18. The ewes were run upon blue grass during the fall, a fairly liberal allowance of corn and cottonseed meal being allowed. They were divided into lots on November 15 and fed the different rations.

It is pretty well conceded that 90% of the dry matter of the fetal lamb is formed in the last half of the gestation period of five months. The influence of the respective feeds, therefore, upon the production of lambs would be quite evident inasmuch as they were on the different rations pratically the last four months of this period on the average.

The character of lambs produced by these various rations may be designated in tabular form as follows :

Lot No.	Av. No. Lambs.	Av. Wt. per Lamb.	Vigor				Condition (*)	
			Strong	Medium	Weak	Dead	Prime to Medium	Medium to Inferior
		lbs.	%	%	%	%	%	%
1	1,67	6,58	60	30	5	5	65	35
2	1,75	7,91	86	5	5	4	76	24
3	1,67	7,44	80	20	none	none	73	27
4	1,33	8,36	81	19	»	»	82	18

(*) Condition was marked on each lamb at birth, using the following scheme with fattest first; prime, choice, good, medium, fair, common, inferior. None of the lots had an inferior lamb. The clover lot, No. 1, was the only lot to have a common lamb, which amounted to 5 % of the total born.

The ewes were so fed as to make their gains practically identical. In the 115 to 120 days the average gains on these rations daily were : lot 1, 0.231 ; lot 2, 0.253 ; lot 3, 0.225 ; and lot 4, 0.237 pound. Thus the factor of gain was uniform. These ewes were what would be considered very well fed, much better fed than the average farm flock.

That corn and corn silage should produce such strong, well conditioned large lambs at birth is somewhat surprising. It so happened that they gave birth to the least number, or 1.33 lambs as compared to practically 1.7 lambs with the other three lots. This of course would tend to make these lambs heavier, because we know that the less the nuumber of offspring in the litter the higher the general thrift, vigor, etc., at birth. However, the difference in the number born is not enough to offset the advantage which the silage fed lambs seem to have. It must be remembered, however, that these ewes were all very well fed and that is quite a factor in the production of good strong lambs no matter what the ration.

The alfalfa ration clearly produced larger and stronger lambs than the clover. The roughages, silage and clover, when combined were not as efficient seemingly as either alone. This is contrary to the results of a year ago and may possibly be due to the fact that the clover used was not of the choicest quality; however, it was good clean bright hay and was eaten to a considerable extent by the ewes. It was not as leafy as good choice hay but rather inclined to be somewhat stemy. The alfalfa had been raised at the Station and was of choice quality.

The average daily ration per ewe and the daily feed cost were as follows:

Lot No.	Daily Ration				Daily Cost of Feed per Ewe. — cents.
	Corn — lbs.	Clover — lbs.	Alfalfa — lbs.	Silage — lbs.	
1	0.802	2.909	none	none	2.47
2	0.799	none	2.71	none	2.74
3	0.587	1.74	none	2.877	2.03
4	1.020	none	none	4.717	1.66

The feeds were charged as follows: Shelled corn 50 cents a bushel or 89.3 cents a hundred, clover hay 12.00 a ton or 60 cents a hundred, alfalfa hay $15.00 a ton or 75 cents a hundred, corn silage $3.20 a ton or 16 cents a hundrd.

That the daily cost of feed per ewe is decreased by the use of silage is clearly shown. As compared with clover and alfalfa the cost is much less, or practically one-third.

The chances are that the ration could be made more economical and much more efficient if some cottonseed meal or oil meal were added to corn silage when allowed the ewes. It would result in not only cheapening the ration but in healthier lambs. The addition of some oats would

be of some value, especially when they are moderate in price, as this year, 1912. Oats is a premier feed for ewes at any rate and they may be given a small allowance.

In figuring the cost of lambs at birth with the above rations, taking into consideration the cost of feeding during the winter period, cost of pasture and crediting the ewe with the average wool clip, it appears that the lambs cost on the average practically seven to ten times as much where silage is not used as where it is. For instance, last year the lambs at birth cost on clover and alfalfa practically $1.25 each at birth, while on the ration of clover-silage and silage the costs were respectively, 60 and 13 cents. This does not count depreciation, interest on the investment, possible loss of ewes due to sickness and accident, nor building space. It does assume, however that the manure dropped offsets the labor in taking care of the sheep.

The time has come when every corn belt farmer who is in the sheep business must preserve a part of his corn in the silo if he wishes to keep pace with his neighbours. The erection of silos is proceeding at an unprecedented rate in Iowa this year and will continue until practically every up-to-date stock farmer possesses one. It is inevitable that it should be so.

PIGS

1657 - Probable Error in Pig-feeding Trials.

ROBINSON, G. W. and HALNAN, E. T. (School of Agriculture, Cambridge) in *The Journal of Agricultural Science*, Vol. V, Part 1, pp. 48-51. Cambridge, October 1912.

Among the many records of pig feeding trals, access to which the authors have been able to obtain, only two series are of any use for the calculation of probable error. In all the other records where any considerable number of pigs were under experiment, their individual weights were not recorded.

In a series of experiments described in the *Tenth Annual Report* (1911) *of the West of Scotland Agricultural College*, several batches of 8 pigs were fed for 10 to 11 weeks, each on the same diet. The individual weights at the beginning and end of the experimental period are recorded. From these weights the probable error on one animal, found by the usual least square method, works out for the different batches of 8 pigs at from 4 to 12 per cent. of the live weight increase. The pigs were of both sexes and of various sizes.

Probable errors have also been worked out from the weights of individual pigs recorded in the *Report of the Wisconsin Experimental Station* for 1895. Two batches of 10 pigs and three batches of 6 pigs were employed and the time of feeding varied from 9 to 15 weeks. No mention is made of sex and the pigs differed considerably in weight. The probable

error on one animal works out at from 6 to 12 per cent. of the live weight increase.

As the results available for examination were so few, it was determined to carry out trials for the express purpose of finding the probable error. For this purpose, eighteen pigs were taken and housed in sets of three in six pens. They were fed on an *ad libitum* ration of sharps mixed into a slop with water. Barley meal was introduced in the ninth week and gradually increased in proportion to the sharps. It was arranged that the animals should always feed to repletion, and the troughs were taken out of the pens half an hour after each feeding time. During the first six weeks of the experiment the food was given three times a day : but, later, two meals a day were given. Records were kept of the amount of food consumed in each pen so that, if any trio of pigs failed to clear up their food, less was allowed for the following meal. Water was provided for drinking, but was seldom touched. Once a week, a pound of small coal was given to each pen of pigs.

Thirteen of the pigs were under experiment on July 31st 1911, but the other five were not obtained till August 7th, so that the experiment, as far as it concerned the whole eighteen animals, began on the latter date. All the pigs were of the Large White breed, and the thirteen which started on July 31st were practically uniform in age and weight, while the other five did not differ greatly from these. All the pigs were castrated males and, at the beginning of the experiment, were on an average ten weeks old.

Weighings were made on July 31st, August 7th, August 26th, and afterwards at intervals of four weeks, the last weighing being on Nov. 21st.

Two pigs died during the experiment from causes which had nothing to do with the conditions of the experiment.

The following (p. 2702) table shows the weights recorded.

From these figure the following results were obtained by the least square method :

1) For the whole number of pigs for the complete period the probable error of one animal was 8 per cent. of the average live weight increase.

2) For the whole number of pigs, the probable error of one animal in the intervals between the weighings was as follows :

a)	18	pigs for	3	weeks	21.6	per cent. of average live weight	increase
b)	17	„ „	4	„	11	»	»
c)	17	„ „	4	„	13.4	»	»
d)	16	„ „	4	„	9.6	»	»

The error, therefore, while greater than that for the whole period, tends to diminish as the pigs get older.

No. of pig	July 31st.	August 7th.	August 26th.	Sept. 23th.	Oct. 23rd.	November 21st.
	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.
1	35	40 ½	52	74	102	—
2	33	37 ½	42	60	93	125
3	40	44 ½	54	78	103	142
4	44	47 ½	59	79	97	128
5	43	35	58	83	104	139
6	37	41 ½	51	75	100	133
7	35	37 ½	42 ½	59	89	119
8	34	37 ½	43 ½	59	83	112
9	40	44 ½	53	—	—	—
10	41	46	58	82	103	132
11	35	42 ½	45 ½	67	85	109
12	36	43 ½	52 ½	75	108	140
13	38	44 ½	54	77	106	129
14	—	31 ½	41	63	88	120
15	—	26 ½	33	47	72	104
16	—	28 ½	37	57	89	124
17	—	29 ½	35 ½	53	74	97
18	—	30 ½	38 ½	55	77	105

3) For the eleven pigs which survived out of the original thirteen the probable error of one animal is 7.0 per cent of the average increase.

4) In the same way as in 2) we get the probable error of one animal as follows:

a)	13 pigs	for 4 weeks	15.7	per cent.	of average live weight increase		
b)	12	„	„	11.2	„	„	„
c)	12	„	„	13.8	„		„
d)	11	„	„	8.0	„	„	„

Here, as in 2), the error diminishes as the pigs get older.

It will be seen that the probable errors calculated in 3) and 4) are little less than those in 1) and 2) showing that accuracy is not greatly increased by uniformity in weight among the animals under experiment.

Uniformity of breed, however, appears to be very important, for in a second experiment on nine animals, some of which were Large Whites and some Middle Whites the rate of increase of the two breeds differed so greatly that the experiment was discontinued.

From the results of these experiments and those obtained from the Scotch and American figures, it appears that the probable error of one animal in a pig feeding experiment is in the region of 10 per cent. of the average live weight increase.

Now, in a comparative feeding experiment, the authors aim at taking such a number of animals that the differences may be with certainty attributed to the effect of the two diets and not to normal variation.

The probable error of an average of n animals is obtained by dividing the probable error of an individual by $\sqrt{n}$. The authors therefore construct a table showing the relation between the percentage live weight increase and the number of animals required to ensure that the differences are not due to normal variation.

Percentage difference in live weight increase to be expected under the conditions of the experiment	Number of animals required in each lot. (Fractions counted as the next highest whole number)
50	1
40	1
30	2
20	4
10	15
5	54

Conclusions. 1) The probable error of one result calculated from a four week period is large, but is diminished as the animals get older and more accustomed to the diet.

2) This error is much reduced by taking a longer period, and 12 weeks may be suggested as the shortest period consistent with accuracy.

3) The probable error of one animal in a mixed lot of approximately the same age and weight is very little more than that in a lot more closely approximating in these respects.

4) A table has been prepared to show the number of animals which ought to be taken to show up varying differences with precision. For example, fifteen animals must be taken in each lot where the two methods of feeding are expected to show a 10 per cent. difference.

1658 – Fattening Hogs in Nebraska.

SNYDER, W. P. and BURNETT, E. A.: *Bulletin of the Agricultural Experiment Station of Nebraska*, Vol. XXIV, Article I. Bulletin No. 123, 40 pp. Lincoln, Nebraska, 1912.

During the past few years the Experimental Substation at North Platte, Nebraska, has been conducting experiments to throw light on the problem of the most profitable use of alfalfa in the fattening ration for pork production. Part I of this bulletin deals entirely with this problem. The results of previonsly reported experiments are summarized and the results of the later experiments are given in detail. The results of several tests in which other grains and mill products are supplemented for a part of the corn in a ration of corn and alfalfa are given in part II.

The prices used in calculating the results are as follows:

	$
Hogs, per 100 lbs.	5.90
Corn, per bushel	0.47
Wheat, per bushel	0 70
Barley, per bushel	0.40
Emmer, per bushel	0.35
Rye, per bushel	0.56
Milo (dourra), per bushel	0.50
Cane (Sorghum) seed, per bushel	0.50
Oil-meal, per ton	30.00
Tankage, per ton	40.00
Bone-meal, per ton	30 00
Shorts, per ton	24.00
Alfalfa-meal, per ton	15.00
Chopped alfalfa, per ton	10.00
Alfalfa hay, per ton	8.00

The cost of alfalfa pasture has been considered as 25 cents per month or 0.8 cent per day per hog not being fed grain, or one-half that amount for hogs fed about a full grain ration. Pigs have been charged less.

Group *A* includes two experiments, in each of which there were 7 lots of 10 pigs each; group *B*, four tests in each of which there were 10 pigs on each ration; group *C*, three tests in each of which there were 10 pigs fed each of the rations; group *D*, three experiments in each of which there were 10 pigs on each ration. The average duration of each test was about 3 months, from November to February.

The feeding of various proportions of alfalfa in a ration of corn, as alfalfa hay, as chopped hay, and as meal, indicated that the rations

Comparison of rations for fattening hogs.

RATION	Average 1st weight	Average last weight	Average daily gain	Grain for 100 lbs gain	Cost of 100 lbs gain	Profit per pig daily
	lbs.	lbs.	lbs.	lbs.	$	$
Group A. *Average of two tests.*						
Corn	118.7	220.7	1.08	518	4.35	0.016
Corn and alfalfa hay in rack . .	118.5	234.5	1.18	448	3.81	0.026
Corn 9 parts, chopped alfalfa 1 part	120.0	245.8	1.31	441	3.94	0.025
Corn 3 parts, chopped alfalfa 1 part	118.2	227.2	1.11	435	4.85	0.017
Corn 3 parts, alfalfa-meal 1 part	115.0	230.7	1.20	403	4.39	0.019
Corn 1 part, chopped alfalfa 1 part	115.2	190.0	0.78	355	4 76	0.009
Corn 1 part, alfalfa-meal 1 part	115.2	195.4	0.82	346	5.49	0.004
Group B. *Average of four tests.*						
Corn	137.4	259.1	1.35	492	4.13	0.025
Corn 9 parts, chopped alfalfa 1 part	138.0	275,5	1.52	429	3.83	0 031
Corn 3 parts, chopped alfalfa 1 part	136 0	240 9	1.14	426	4.28	0 018
Corn 3 parts, alfalfa-meal 1 part	134.6	252 5	1.30	400	4.36	0 020
Group C *Average of three tests.*						
Corn	137.3	266	1.40	483	4 04	0.027
Corn 9 parts, chopped alfalfa 1 part	136.3	283	1 58	425	3.80	0.033
Corn 9 parts, alfalfa-meal 1 part	134 3	283.6	1.59	431	3.97	0.031
Group D. *Average of three tests.*						
Corn	135.3	249.8	1.27	506	4.25	0.022
Corn and alfalfa hay in rack . .	135.1	270.9	1.50	436	3.78	0.032
Corn 9 parts, chopped alfalfa 1 part	136.5	269.2	1.46	433	3.87	0 029

rank as follows, with the most satisfactory ration, viewed from the profit made per hog fattened, at the top of the list :

1. 100 parts corn and alfalfa hay in a rack.
2. 90 ,, ,, ,, 10 parts chopped alfalfa.
3. 90 ,, ,, ,, 10 parts alfalfa meal.
4. 100 ,, ,, ,, alone.
5. 75 ,, ,, ,, and 25 parts alfalfa meal.
6. 75 ,, ,, ,, 25 parts chopped alfalfa
7. 50 ,, ,, ,, 50 parts chopped alfalfa.
8. 50 ,, ,, ,, 50 parts alfalfa meal.

The first three rations stand closely together. Corn seems to have a stationary place between a ration of 10 parts alfalfa and 90 parts corn and a ration of 25 parts alfalfa and 75 parts corn.

Part. II. *Comparisons of Corn, Corn and Alfalfa, and Supplementary Foods for fattening Hogs.* The following is the summary of the results:

1. Of the many rations tried for fattening, none has been found the equal of corn and a small percentage of alfalfa.

2. Wheat gives faster gains with less grains per 100 lbs. of gain than corn, but the high cost of wheat makes the gains from wheat more expensive than from corn. The profit per pig; il fed one-half wheat and one half corn while being grown and fattened, is less than if fed corn. This is when both grains are fed with alfalfa.

3. A ration of barley and with alfalfa does not give as fast gain or as much profit per hog during the growing and the fattening periods, as a ration of corn and alfalfa.

4. The substitution of 5 parts tankage, 5 parts bone-meal, or 25 parts shorts, for corn, in a ration containing 90 parts corn and 10 parts chopped alfalfa, increases the cost of gains and decreases the profit per pig during the fattening period.

5. The susbtitution of 25 parts emmer, barley, wheat or milo, for corn in a ration containing 90 parts corn and 10 parts chopped alfalfa, increases the cost of gains and decreases the profit per hog during the fattening period, excepting emmer, which alone in this test increased the profit per hog. The wheat increased the gains but decreased the profit. The emmer also increased the gain. Barley and milo decreased the gain as well as the profit. Milo was worth the same price per bushel as barley in this test.

6. The result of one test indicated that a bushel of corn was worth as much as a bushel and a falf of cane seed when fed with alfalfa for fattening hogs.

7. Where fall pigs were wintered and turned on alfalfa pasture in the spring, there was more profit per pig from those grown out largely on pasture and then fattened than from those fed out more quickly.

8. Four seasons' records show that old sows being fattened on corn and alfalfa pasture gained 2 lbs. per head daily, ate 355 lbs. of corn for 100 lbs. of gain and gave a net profit of over 5 cents each daily.

9. The cost of feed to produce a 255 lbs. market hog was $3.35 per 100 lbs; and that for keeping the hog until it weighed 325 lbs. increased the cost to $3.57 per 100 lbs. This includes only the cost of feed and does not include the cost of labor, equipment, unusual risk, or interest on investment.

1659 - Hog Raising for the Idaho Farmer.

CARLYLE, W. L. and IDDINGS, E. J.: *Idaho Experimental Station, Moscow, Idaho: Department of Animal Husbandry. Bulletin* No. 74, 31 pp. Moscow, Idaho, August 1912.

In the north west States of America, the demand for pork exceeds the supply; thus large sums of money find their way to the eastern States which could have been expended in the north-west and profited the local farmers. These might with advantage turn their attention to employing in hog-raising certain products which at present are wasted, such as the shattered wheat which is lost in harvesting with the combine and scattered round the separation in conveying it to the machine, either in threshing from the field or stack. Skim milk is also a by-product which can be used with advantage by the hog. The summer fallows of the dry farming sections, in many cases, can very profitably grow corn, field peas and other crops of similar nature; the newer irrigated sections have thousands of acres in alfalfa that may be utilized to great advantage by pasturing them with hogs. An acre of alfalfa will keep from 15 to 20 pigs during the summer, and with grain in addition, will make very profitable gains and a high quality of pork. The Missouri Experiment Station made a test of the pork producing capacity of different pastures, when used with a partial grain ration. Valuing pork at 6 cents per lb., the returns given in table I were secured for a season's pasture. The western alfalfa produces more heavily, grows more rapidly, and is of higher protein content than the eastern grown alfalfa.

A Comparison of Pastures for Pork Production.

	Pounds of Pork per Acre of Pasture	Value of Pork from Acre of Pasture
	lbs.	$
Blue Grass	295.2	17.71
Alfalfa	596.8	35.71
Clover	572.2	34.11
Rape, Oats and Clover	394.0	23.64
Cow Peas	224.9	13.16
Soy Beans	183.1	10.99
Corn	395.2	23.71
Rye Grass	244.3	14.66

Having mentioned the market conditions for pork in Idaho, the writer goes on to describe the fattening experiments carried out by himself in 1910-1911.

Feeds used in the following experiments, if bought in ton lots, are charged at the average prices during the last five years:

	Per Cwt
Ground wheat	$1.25
Cracked corn	$1.40
Wheat shorts	$1.10
Rolled barley	$1.10
High protein tankage	$2.00
Low protein tankage	$1.50
Field peas	$1.50
Soy bean meal (guaranteed to contain 50 % protein)	$1.90

The pigs used for experiment were sold at $7.50 per cwt.

Experiment I. This was conducted from March 22 to June 28, 1910, for the purpose of testing the value of tankage as a supplementary feed in finishing pigs for market. The results are given in Table II.

Experiment II. lasted from August 29th to December 12th, 1910; it was undertaken to determine the comparative values of ground corn, field peas, soy bean meal and tankage when fed supplementary to a basic ration of four parts shorts and two parts barley. The pigs used for the work consisted of pure-bred Duroc Jerseys, grade Poland Chinas, and cross-bred Poland China-Duroc Jerseys. The results are given in table III.

Experiment III. This lasted only from September 13th. to November 8th., 1911. It was undertaken to determine the relative value of tankage and soy bean meal, when used supplementary to a rolled wheat ration. The pigs used for this test were Poland Chinas and Duroc Jerseys. The results are to be found in table IV.

For the reason that the feeding value of tankage as a supplement to standard grain rations is under investigation in each experiment, table V is given to summarize and compare results. Columns 1, 2 and 3 give the results of the addition of tankage in the first three experiments. The results in average daily gain, feed required for 100 lbs. gain, and net profit per pig, are so near together as to commend them as dependable. In columns 4 and 5 the average of tankage and non-tankage fed lots are compared. Tankage makes the better showing from every point of view.

Conclusions.

I. Tankage feeding supplementary to standard single grain or mixed rations gives a better appetite to the pigs and means for higher water consumption, more rapid gains, less cost of same and greater net profit per pig as compared with other supplements used.

II. In Experiment I, 84 lbs. of high protein tankage fed to Lot 2 replaced 25 lbs. of corn, 25 lbs. of shorts, and 50 lbs. of wheat as compared with Lot 2 in making 100 lbs. gain, and was worth $29.74 per ton. In making 100 lbs. of gain in Experiment II, 37 lbs. of high protein tankage replaced 4 lbs. of shorts, 2 lbs. of barley and 75 lbs. of corn and was worth $60.34 per ton as compared with corn at $28.00 per ton; 37 lbs. of tankage, 44 lbs. of shorts and 22 lbs. of barley replaced 125 lbs. of peas, and the tankage was worth $62.56 per ton as compared with field peas at $30.00 per ton; 37 lbs. of tankage, 4½ lbs. of shorts and 2¼ lbs. of barley replaced 71 lbs. of soy bean meal, and the tankage was worth $65.52 per ton as compared with soy bean meal ar $38.00 per ton. In Experiment III, 36 lbs. of low protein tankage replaced 6½ lbs. of wheat and 37 lbs. of soy bean meal in making 100 lbs. of gain and as compared with soy bean meal was worth $43.04 per ton. An average of the five results given above shows tankage to have a value of $52.24 per ton when used with grains in proportion of from one in thirteen to one in five.

III. Poorest results with tankage were secured in Experiment I when it was fed one to five. The ratios of one to eleven and one to twelve gave much better results and are undoubtedly more economical for average farm use.

IV. The smallest amount of feed for one hundred pounds of gain was used in the first experiment with hogs fed under cover, on board floors and permitted but little exercise.

V. A wheat ration supplemented with one-twelfth tankage for a feeding period of fifty-six days made 0.07 pound greater daily gain and required but 2.8 per cent more feed for one hundred pounds of gain as compared with a more varied ration—wheat, corn and shorts, supplemented with one part tankage in five as found in Experiment I. In a similar manner the wheat and tankage ration as fed in Experiment III showed more rapid daily gains and more economical gains than any lot of Experiment II, where a much more varied ration was fed, and in average net profit per pig excelled all lots of Experiment II except four, where the tankage supplement produced a net profit of $3.89 per pig as compared with $3.35 for tankage feeding in Experiment III. In a similar way wheat and soy bean meal in Experiment III produced more rapid gain than Lot 1, Experiment I, and was not far from either lot in economy of gain. As compared with Experiment II, wheat and soy bean meal required less feed for one hundred pounds of gain than any of the lots, made more rapid gains than any lot but 4 and more net profit per pig than lot 3, and near the results in net profit of Lots 1 and 2. This indicates the success to be attained by heavy use of wheat for short feeding periods where a rich protein concentrate, such as tankage or soy bean meal, is used as a supplement in proportion of one in ten to one in thirteen.

TABLE II. — *Results of First Experiment, March 28 to June 28, 1910.*

Lots	Lot 1, 8 pigs	Lot 2, 8 pigs
Rations	Wheat 2 Corn 1 Shorts 1	Wheat 2 Shorts 1 Corn 1 Tankage 1
Total weight beginning	538 lbs.	604 lbs.
Total final weight	1461 »	1688 »
Total gain	923 »	1084 »
Average daily gain	1.18 »	1.38 »
Days fed	98	98
Feed consumed	4046 lbs.	4575 lbs.
Feed for 100 lbs. gain	438 »	422 »
Cost of feed	$ 50.39	$ 63.29
Cost of 100 lbs. gain	$ 5.46	$ 5.84
Cost of hogs at 6 cts.	$ 32.28	$ 36.24
Gross returns	$109.57	$126.60
Net profit for lot	$ 26.90	$ 27.07
Net profit per pig	$ 3.36	$ 3.38

TABLE III. — *Results of Second Experiment, August 29 to December* 1910.

Lots	Lot 1 11 Pigs	Lot 2 12 Pigs	Lot 3 12 Pigs	Lot 4 12 Pigs
Rations	Shorts 4 Barley 2 Corn 1	Shorts 4 Barley 2 Peas 2	Shorts 4 Barley 2 Soy Bean Meal 1	Shorts 4 Barley 2 Tankage 1/2
Total weight beginning	820.00 lbs.	884.50 lbs.	862.50 lbs.	871.50 lbs.
Total final weight	2 273.00 »	2 583.00 »	2 471.00 »	2 629.00 »
Total gain	1 453.00 »	1 698.50 »	1 608.50 »	1 757.50 »
Average daily gain	1.26 »	1.35 »	1.28 »	1.40 »
Days fed	105.	105.	105.	105.
Feed consumed	7 580.00 lbs.	8 498.00 lbs.	8 025.00 lbs.	8 401.00 lbs.
Feed for 100 lbs. gain	521.80 »	500.30 »	498.90 »	478.00 »
Cost of feed	$ 86.62	$101.97	$ 97.44	$ 98.22
Cost 100 lbs. gain.	$ 5.96	$ 6.00	$ 6.06	$ 5.59
Cost of hogs at 6 cts.	$ 49.20	$ 53.07	$ 51.75	$ 52.29
Gross returns	$170.00	$193.00	$185.33	$197.18
Net profit	$ 34.66	$ 38.69	$ 36.14	$ 46.67
Net profit per pig	$ 3.15	$ 3.22	$ 3.01	$ 3.89

TABLE IV. — *Results of third Experiment, September 13 to November 8, 1911.*

Lots	Lot 1, Eight Pigs	Lot 2, Eight Pigs
Rations	Wheat 11 Tankage 1	Wheat 11 Soy Bean Meal 1
Total weight, beginning	930 lbs.	941 lbs.
Total final weight	1 580 »	1 555 »
Total gains	650 »	614 »
Average daily gains	1.45 »	1.37 »
Days fed	56	56
Feed consumed	2 823 lbs.	1 706 lbs.
Feed for 100 lbs. gain	434 »	441 »
Cost of feed	$ 35.87	$ 35.29
Cost of 100 lbs gain	$ 5.52	$ 5.75
Cost of hogs at 6 cts	$ 55.80	$ 56.46
Gross returns	$118.50	$116.63
Net profit	$ 26.83	$ 24.68
Net profit per pig	$ 3.35	$ 3.11

TABLE V. — *Summary of Results.*

No. Experiment	I	II	III	Summary	Summary Lots Fed other than Tankage
Rations used	Wheat 2 Corn 1 Shorts 1 Tankage 1	Shorts 4 Barley 2 Tankage ½	Wheat 11 Tankage 1	Tankage Fed Lots	
Average gain	135.5 lbs.	146.5 lbs.	81.3 lbs.	121.1 lbs.	119.9 lbs.
Average daily gain	1.38 »	1.40 »	1.45 »	1.41 »	1.29 »
Days fed	98	105	56	86.3	93.8
Average daily ration	5.83 lbs.	6.67 lbs.	6.30 lbs.	6.28 lbs.	6.17 lbs.
Feed for 100 lbs. gain	422 »	478 »	434 »	445 »	480 »
Cost 100 lbs. gain	$5.84	$5.59	$5.52	$5.65	$5.85
Net profit per pig	$3.38	$3.89	$3.35	$3.54	$3.17
Net profit daily per pig	$3.45 cts.	$3.70	$5.98 cts.	$4.38 cts.	$3.58 cts.

VI. Very satisfactory results secured in Lot 1, Experiment III, seems to indicate a comparatively high feeding value for low protein tankage. Further investigations of this question will be undertaken.

VII. By charging pigs at six cents, regarded as reasonable for pigs and thin shotes, and figuring selling price at seven and one-half cents, which is the actual average selling price of the three experimental groups, commercial prices are received for all grains and other feeds used and a liberal net profit in addition. Eighty pigs were fed in the three experiments and the average net return per pig was $3.27. Pig feeding as shown by this experimental data, therefore, affords the farmer a home market for his grains and farm by-products, and for a feeding period of from fifty-six to one hundred and five days returns the feeder better than $3.00 net profit per pig.

1660 – **The Automatic Dry-feeding of Pigs. Comparative Fattening Experiments.**

DE LA BARRE. Die automatische Trockenfütterung der Schweine; vergleichender Mästungsversuch — *Mitteilungen der Versuchsstation für landwirtschaftliche Fütterungsversuche in Karstädt*, Year 5, Nos. 7 and 9, pp. 49-53, and 65-68. Breslau, July 28 and September 29, 1912.

The agricultural experiment station of Karstädt has tried an automatic feeding apparatus (Stoltenberg's) for pigs. This automatic feeder consists of a wooden hopper under which a feeding trough sheathed with zinc is fastened. Through an opening provided with a moveable flap, the aperture of which may be regulated, in the lower part of the hopper, the food falls into the trough when the pigs move the flap. When the apparatus works properly only a small quantity of food falls at a time into the trough so that the pigs cannot waste any.

An automatic feeder can be used only when the pigs are exclusively fed dry foods (crushed cereals, meal, potato flakes, fish meal, etc.). It can contain, according to its size, food for a few days or for a week or still longer periods, and it can be kept in a stable or in the open under a shed. Drinking water in a separate vessel must be provided for the pigs.

The advantages of automatic feeding are that fattening pigs — as it is for these that the apparatus is designed — can always have enough food at their disposal and that they can always get it when they like. Besides which, the labour of distributing food several times in the course of the day is saved.

A feeding experiment was conducted with the object of testing the automatic feeding and of comparing it with the usual way of feeding.

Two equal groups of six store pigs were used. The pigs were improved Hanoverians. The food given was a mixture of meal and crushed cereals, some crushed horsebeans and fish meal.

The pigs of Lot I were fed three times a day with a thick mash of this mixture, in quantities corresponding to their appetite. After feeding they were given fresh drinking water.

Lot II received exactly the same mixture as Lot I, but in a dry form from the automatic feeder, near which fresh water, changed twice a day, was available. Every evening some comfrey was given to each lot.

The fattening period lasted 87 days and proceeded without any interruption. The results are shown in the following table:

TABLE I.

Lot	Initial weight	Gain	Final weight	Sale price per cwt.	Total of sale	Cost of food (*)	Cost price of pigs	Total cost food and pigs	Gross Profit
	lbs.	lbs.	lbs.	£ s d	£ s d	£ s d	£ s d	£ s d	£ s d
I	659	747	1046	2-17-8	36- 5-3	11-18-9	17-12-9	29-11-6	6-13-9
II	652	855	1507	2-17-8	38-17-6	14- 3-4	17-12-9	31-16-1	7- 1-5

*The food stuffs are reckoned at market prices. Lot II spilled on the ground and wasted from 100 to 150 lb. of food owing to defective construction of the automatic feeder. This wasted food is included in the calculation.

The last column of the Table shows that the automatic fed Lot II yielded a somewhat higher gross profit than Lot I. The greater consumption of food by Lot II is abundantly compensated by the greater gain in live weight; the fattening of pigs with dry food using the automatic feeder is therefore to be recommended.

1661 - **The Goat in the Pyrenees.** GOATS

GIRARD, F. La Chèvre dans les Pyrénées, *La vie agricole et rurale*, No. 44, pp. 479-484. Paris, September 28, 1912.

In the French Pyrenees, stock-breeding constitutes the most important branch of rural industry. Of late years, there has been a considerable increase in cattle and pig rearing, leading to the neglect of sheep and goats. The progressive decrease in the flocks of goats is due, in a great measure, to the stand made by forest agents for better management and the reafforestation of the mountains, which they consider menaced by the havoc wrought by the goats. On the other hand, the latter animal cannot be

replaced on the hot, dry mountain districts by either cows or sheep, but will always hold its own there.

The present number of goats in the French Pyrenees is about 100 000 head, distributed as follows :

Pyrénées-Orientales	30 000
Landes	27 500
Basses-Pyrénées	16 000
Hautes-Pyrénées	8 200
Ariège	6 000
Haute-Garonne	4 000

The Pyrenean goat belongs to a native breed and has, in general, well retained its original type. It has certainly undergone some changes as the results of importation and of attempts at crossing, but the type is found nearly unchanged in the case of most of the animals of the flocks of the western half of the chain.

The folllowing are the characteristics of this breed : They are distinctly short in the head, which is strong without being heavy and the poll is especially well-developed ; the forehead is very wide and rather flat, sometimes a little dished between the eyes, and presents a large surface of insertion for the large horns and the orbits which project around the large, yellow, well-formed and expressive eyes. The ears are erect, pointed, straight and sometimes a little heavy ; they are 4 to 6 inches long and 2 to 2½ broad ; their mobility betrays the sensitive nature of the animal. The face is moderately elongated, broad at the base, a little furrowed beneath the arch of the brows, but well filled out on the cheeks, and straight or slightly depressed above the pointed muzzle.

The males possess very large horns in the form of open spirals and provided in front with thick protuberances. The horns of the females are smaller, directed parallelly upwards and backwards and slightly curved. Both sexes have long beards.

The Pyrenean goat develops rapidly ; at the age of four years its average height is 28 in. and an adult animal seldom weighs less than 130 lbs. and may even reach 165 or 175 lbs. From the nape of the neck to the root of the tail it measures about 4 ft., and its girth is almost the same as the length of its body.

This goat is strongly built, well-shaped, slender, without being thin, not very high on its legs and well proportioned. Like all its race, it has a long thin neck, narrow shoulders, a narrow chest, not deep, but very high giving good play for the lungs ; its withers are slight and projecting, followed by a long sharp back, but from the loins, the transverse development is noticeable; the haunches are wide apart and project much, the rump is wide, short and much inclined, but with relatively powerful muscles,

which project at the level of the thighs. The legs are long and slender, with large bony articulations; they are terminated by well-made, strong feet furnished with very hard black hoofs. The limbs are well under the body and straight, suitable to an animal which is a good walker.

The hair is long, or semi-long, it is hard, thick, compact, very strong, and forms a thick fleece, which protects the animal from the cold. It is not uniformly developed over the whole body; very short on the head, neck, and legs, it grows much longer on the body, especially on the shoulders and at the level of the thighs, where it makes thick pendent locks. The coat is monochrome and presents every shade of brown, from fawn to black; pure-bred Pyrenean goats are black. Often in the low-lying valleys, the forehead and face become lighter in colour, and two grey bands run down the cheeks from the base of the ears to the corners of the mouth while the hair of the legs, which is finer, shows mauve, yellow, or grey colouring of all shades extending from the knees, or hocks to the hoofs. In this case, the base and interior of the ears, the lower part of the belly, the interior of the thighs and the borders of the tail show the same signs of depigmentation; the Béarnaise breed is black, with white belly, and light, grey, or yellow extremities.

The Pyrenean goat is thriftly, strong, disease resistant and seems specially made for the mountains. It is noteworthy that though it adapts itself to the unfavourable conditions of high altitudes, it remains more slender and smaller in such regions than in the valleys.

In the eastern Pyrenees, the type is somewhat different. Traces still remain there of crosses made about 1815 with Thibetan goats with a view of combining milk production with an improved fleece. These crosses were a failure. Further, the climate, the hot sun and scorching winds from Africa have caused the size of the animal to decrease, so that it more nearly resembles the Spanish type of goat (from Murcia).

The Pyrenean goat gives from 3½ to 5 pints of milk daily; it is not unusual to find animals yielding 7 to 9 pints a day. The lactation period may last from 10 to 12 months, but usually ceases from 6 to 7 months after the birth of the kid. Under ordinary breeding conditions, an average goat gives from 100 to 110 gallons of milk annually.

The milk is consumed as it is, either in the household or sold by glassfuls in the towns, which is a very remunerative trade. Every spring, flocks of 15 to 20 goats under the care of a goat herd set out for the large towns of France, and even of Belgium. The journey is accomplished in stages and takes sometimes as long as 30 days. The flocks, on their arrival, are installed in the outskirts of the town which is their destination, and the goatherd drives his flock past the houses of his customers every morning and milks the animals before their eyes. In October the flocks return to the Pyrenees.

In conclusion, the writer speaks of the improvements which are desirable in the breeding of Pyrenean goats; it is necessary to practise selection, and by better training and treatment to improve the form and capabilities of the breed, while rendering it impossible for the goats to interfere with the reafforestation or cultivation of the mountains.

POULTRY

1662 - A New Haematozoon of the Pigeon.

CARINI, A. Sur un nouvel Hématozoaire du Pigeon — *Comptes Rendus hebdomadaires des Séances de la Société de Biologie*, Vol. LXXIII, No. 29, pp. 396-398. Paris, October 25, 1912.

At the Pasteur Institute at São Paolo in Brazil, the writer found, on examining the blood of a pigeon, a new parasite, which seems to be of rare occurrence, since in spite of much research, he has failed in finding it a second time.

The parasite is almost entirely confined to the interior of the blood corpuscles, the latter are not hypertrophied or rendered colourless. When the parasite is large, the nucleus of the corpuscle is pushed to one side. Amongst the blood corpuscles which are free from the parasite, there occur very rarely some which have a spotted appearance. The haematozoon, observed when alive, looked in the red globule, like a clear, refringent body containing granules of pigment. Not infrequently two, or even three, parasites are to be found in the same corpuscle. According to its stage of development, the hæmatozoon presents itself under slightly different forms, of which the writer gives a description and figures. The chief forms are: very small ones (2-3 μ in diameter) intermediate, round or oval; dumb-bell shaped (up to 9-11 μ long by 4-5 broad); forms with pseudopodia.

The writer suggests for this new pigmented hæmatozoon, which is related to *Haemoproteus* and *Plasmodium*, the name *Plasmodium Columbae*, with doubt as to the correctness of the generic name.

1663 - Bee-keeping in Tunis.

COSTANTINO, A. L'apicultura in Tunisia. — *Bollettino della Società africana d'Italia*, Year XXXI, Parts VII-VIII, pp. 155-161. Naples, July-August 1912.

The progress of bee-keeping in Tunis appears evident from the following table which shows that the exports of honey and wax from Tunis rose from £7 690 in 1906 to £13 046 in 1910. If to this average yearly exportation of £8 362, the value of the honey and wax consumed in the country and for which no statistics are available, be added, an idea will be formed of the importance of the bee-keeping industry in Tunis.

Exportation of Honey and Wax from Tunis.

	HONEY				WAX				TOTAL		
	lbs.	£	s.	d.	lbs.	£	s.	d.	£	s.	d.
1906. . .	9 178	248	6	8	121 937	7 442	6	9	7 690	13	5
1907. . .	47 150	1 275	14	4	316 664	9 995	13	5	11 271	7	9
1908. . .	6 057	163	16	11	170 770	5 390	9	5	5 554	6	4
1909. . .	9 000	243	9	10	213 589	7 705	4	8	7 948	14	6
1910. . .	19 085	516	7	0	231 554	12 529	19	11	13 046	6	11

The greatest producers of honey and wax are the Arabs; next come the French farmers with their improved methods, and lastly the Italian farmers. In Tunis the hills are covered with rosemary and thyme which are in bloom for many months of the year and yield a highly perfumed honey. The plains during a part of the winter and throughout the spring are covered with flowers and it may safely be stated that in the whole year the only season unfavourable to the production of honey in Tunis is the summer. For this season a reserve of honey should be left in the hives. The worst enemy of bee-keeping in Tunis is the petty Arab thief, but against this evil the beekeeper must guard by keeping his hives near his houses and the State should provide for the protection of farm produce against pilfering. For the further improvement of bee-keeping, which already in the hands of the Arabs gives such good results, the spreading of theoretical knowledge is highly to be recommended. In this connection a French bee-keepers' association deserves to be mentioned, for thanks to its activity, every year the number of hives kept on the colonists' farms goes on increasing. Some farms already possess hundreds of hives.

1664 - **Sericulture in Ceylon.** SILKWORMS

The Tropical Agriculturist, Vol. XXXIX, No. 3, pp. 225-227. Colombo, September 1912.

The following is a Report presented by Prof. Dunstan to the Ceylon Agricultural Society on samples of silk produced at the Peradeniya Silk Farm (under the management of the Salvation Army). The two samples of silk which are the subject of this report, were forwarded to the Imperial Institute by the Ceylon Agricultural Society.

The silks were examined with the following results:

	Sample No 1. Product of the Mysore Silkworm	Sample No 2. Product of a Hybrid between Mysore and Bengal Silkworm
Moisture	9,3 per cent.	9,9 per cent.
Loss in weight on degumming with a 1 per cent. soap solution . . .	26,1 per cent.	21,9 per cent.
Colour and lustre after degumming .	Pure white and highly lustrous. 17 and 19 deniers, average 18 deniers (international).	Cream coloured and highly lustrous. Irregular; 15 to 20 deniers, average 17.5 deniers (international).

The samples were submitted to a firm of spinners, who described them as marketable silks and valued No.1 at about 12*s.* to 13*s.* per lb. with East Indian Surdah silk at 11*s.* 3*d.* to 11*s.* 9*d.* per lb. The spinners expressed their willingness to carry out practical trials with large samples of these silks in order that their value may be accurately ascertained.

The Peradeniya Silk Farm exhibits and demonstrations at the All Ceylon Exhibition in July were among the most interesting features. Mysore silk was sold for 13*s.* 4*d.* per lb., while a year ago it was fetching only 10*s.*

The Commanding Officer of the Salvation Army in forwarding a sample of thread made of the silk spun by the muga worm (*Antheraea assama*) writes: "The worm likes a damp climate and feeds on various kinds of laurel including the cinnamon. It might therefore do very well in Ceylon. I should appreciate your opinion. Commissioner Booth Tucker tells me he has 300 maunds of cocoons (say 24 000 lbs.) for reeling purposes. Seeing we have so much cinnamon in Ceylon and there is no market for the leaves, it might be easier to get some to start with the muga worm, and it might add to the profits of the cinnamon growers and indirectly help out that industry as well. The muga silk is much more brilliant than the eri and is reelable, two points greatly in its favour. I think the muga feeds on several kinds of leaves besides cinnamon, such as a species of laurel known as Soom (*Machilus odoratissima*), the Champac (*Michelia champaca*) and the Suabi (*Tetranthera monopetale*)." The Government Entomologist reporting with reference to the above, points out that the worm is closely allied to the Tussar silkworm but produces a white and glossier silk, that the eggs are hatched indoors, but the worms are placed on trees outside for feeding, being brought in again when about to spin. He considers it likely that the muga will thrive in Ceylon and that it should

certainly be given a trial, remarking that if it feeds upon cinnamon in India it will certainly do so in Ceylon too, and probably also on various species of *Litsea*.

1665 - Wild Silkworms in Africa.

MICHEL, E. Vers à soie sauvages d'Afrique. — *Bulletin Agricole du Congo Belge*, Vol. III, No. 3, pp. 581-588. Bruxelles, September 1912.

From the report received from Mr. Gordey, the Government Entomologist of the Protectorate of Uganda, respecting the species of wild silkworms which exist in that country, it appears that the following are met with : *Anaphe infracta* Wals., *Hypsoides mulleti* Juan, and *Mimopacha gerstaeckeri* Dew. *Anaphe infracta* is chosen for exploitation in preference to the other wild species of silkworms, because it is the most abundant and produces the most silk.

According to Dr. Schouteden, one of the Staff of the Museum of the Belgian Congo at Tervueren, the genus *Anaphe* belongs to the family of the *Notodontidae*, and all its species inhabit Ethiopian Africa. The larvæ of these moths collect in larger or smaller numbers and build common nests of which the dimensions, colour, and size differ considerably for the same species. Within these nests the caterpillars spin their cocoons and carry out their metamorphoses.

The Staff of the Congo Museum, having received at different times nests of *Anaphe infracta* and *A. venata*, have been able to rear and study many specimens of the two species. *Anaphe infracta* is distinguished from *A. venata* by the dark chocolate brown colour of its nest, which has an entrance to which the strands of silk converge and where the tissue is much easier to penetrate than in the rest of the nest, which consists of a series of silk layers enveloping the mass of cocoons. The study of *A. infracta* has shown that it should not be considered as a variety of *A. panda* Bdv., of which there is a specimen in the Brussels museum; this was determined by Aurivillius, and came from Kinshasa, as did also the type specimens of *A. infracta*.

The *Anaphe* moths appear at two seasons of the year ; those of the first brood leave their cocoons in September and those of the second in January. The only difference between the two broods is the duration of the pupal stage, which is 13 weeks for the September brood and only 6 weeks for the other. The life cycle lasts from 327 to 419 days : the September brood seems less fertile than the January one.

The *Anaphe* caterpillars avoid the sun's rays. The dimensions of their nests, as well as the number of cocoons in them, are very variable. The weight of these nests varies from 6 to 8 lbs., and they contain from 130 to 600, or even 800 pupæ. The writer has calculated that 25 average-sized *Anaphe* nests, completely cleaned, furnish 2.2 lbs. of raw silk.

The plants which, in Uganda, constitute the food of *Anaphe infracta* are : *Bridelia micrantha, Cynometra Alexandri* and *Triumfetta macrophylla. Bridelia,* which has to be propagated by cuttings and not by seed, and which thrives best when planted closely, and in any case, with a maximum interval of 6 ft. between the plants, is often shaded by intercalated bananas. A *Bridelia* one year old suffices for the maintenance of a colony of 100 caterpillars. Attempts have been made to cultivate the white mulberry, but the *Anaphe* caterpillars refused to eat the leaves and died of starvation ; *Bridelia* seems the best plant for their support. No experimental data so far exist as to the advantages of keeping on the *Bridelia* trees, caterpillars, eggs, or nests, or as to the utility of leaving the nests, once finished, upon the trees until the moths emerge, rather than removing them to shelters prepared for the purpose. In the one case, it is impossible to calculate the damage which may be caused by the nest parasites, whose propagation cannot be checked ; in the other case, the caterpillars are disturbed and this is apt to result in their death. It is necessary to find out whether there are more losses in the one case than in the other.

The principal enemies of *Anaphe* are birds, of which three Uganda species especially feed on the *Anaphe* larvæ : *Chrysococcyx cupreus* Bodd., *Pycnonotus lougardi* Guru., and Yellow Wagtails (*Budytes campestris* Pall). The writer gives a list of some insects which are parasites of *Anaphe* and finishes his article by mentioning, as a proof of the importance of the present exploitation of these caterpillars, the fact that the President of Uganda has informed the natives of the Bukoba district (360 000 in number) that all owners of huts must plant 10 *Bridelia micrantha* trees this year. It appears that the same measure has been adopted as regards the inhabitants of the Ruanda district (3 500 000 in number). The natives, further, are beginning of their own accord to appreciate the commercial value of the nests.

RURAL ECONOMICS

RURAL ECONOMICS

1666 - **The Rent of Farms in Switzerland.**

Die Höhe des Pachtzinses. — *Schweizerische Landwirtschaftliche Zeitschrift,* Year XL, Part 41. Zürich, October 11, 1912.

The question of farm rents is one which greatly interests the agricultural press. The advice which is generally given is to abstain from paying too much, and some writers maintain that a farmer cannot make his living out of a farm if he has to pay for it more than £3 10s. to £4 10s. per acre for rent.

In the first place a distinction must be made between the renting of whole farms and that of single fields (Zupacht). The latter are often a means of completing one's own farm; thus for instance they afford useful employment for a surplus of labour and which without these single fields would have to find employment elsewhere, or they fulfil certain conditions which render them especially adapted to the wants of the farm. In these cases the rent paid for them will not cause any great change in the trend of the farm. No new buildings will be required and the general expenses will not increase; the farmer will therefore be able to pay a somewhat higher rent for them.

Rents naturally vary in different cases and it is impossible to fix them without a thorough knowledge of local conditions.

The Swiss Peasants' Secretariat has set on foot an enquiry on the sums that are actually paid for the rent (Zupacht) of single fields. The data collected cover the period between 1903 and 1910 and contain for the whole of Switzerland 278 items of information. From the same it appears that the rent varies from £1 15*s.* to £7 4*s.* per acre and that prices ranging from £4 10*s.* to £5 10*s.* are not rare. As an approximate average £2 5*s.* may be calculated, but it cannot be stated that a rent of £3 10*s.* is always too onerous for the farmer, because the Secretariat has been able to ascertain that in many cases still higher rents are profitably paid. Anyhow, if this form of renting (Zupacht) has an influence on the final profit of the farmer, the advantages which are due to it are always subordinate to the working of the rest of the farm.

The rent for whole farms is fixed according to other criteria; generally the owner demands from the farmer the interest of the capital represented by the landed property (Landgutskapital) — because only in rare cases does the lessor furnish the agricultural capital also — and he is satisfied with an interest of 3 to 3.5 per cent.

From the enquiry made by the Swiss Peasants' Secretariat it appears that the interest demanded as an equitable return on the whole capital engaged, diminishes with the increase of the acreage of the farm. This is due to the fact that generally small farms are paid proportionally dearer than large ones, and that farm buildings cannot be adapted precisely to the size of the farm and consequently weigh heavier on the small farms. The data worked out by the Secretariat refer to the whole capital of the farm, while the owner is only entitled to the interest on the capital representing the landed property; this according to the enquiry, is on average 80 per cent. of the total capital. Besides, if the owners were to demand everywhere a proportionately higher rent for the smaller farms they would in many cases commit an error against which the farmers would certainly revolt. This principle cannot therefore by any means serve as a guide in fixing the rent. The data elaborated by the Secre-

tariat for the 25 groups into which the farms have been divided lend themselves much better to the purpose. The groups have been formed according to the systems of farming followed and to the geological and economical positions of the farms; the data are thus referred to farms situated in similar conditions.

The following table shows the average interest per acre demanded by the capital invested in the land of some groups of farms, at the rate of 3.5 per cent. on the value of the farms as estimated by their owners.

Average 1901-1910.

System of farming	Number of accounts closed	Interest demanded on capital in land at 3.5 p. cent.		
		£	s	d
I. Three-year rotation farms	391	2	8	9
II. Clover-ley farms	509	2	6	4
III. Grass farms with some arable land	205	2	10	7
IV. Pure grass farms in German Switzerland	156	3	0	10
V. Pure grass farms in the best fruit regions	66	3	10	7
VI. Pure grass farms in the Alpine valleys	132	2	12	5
VII. Alpine grazing farms	65	1	12	0

The capital in land is higher in the pure grass farms than in those under a three-year rotation or in the clover farms. It reaches its maximum value in the grass farms in the best fruit regions, and where the owner must demand a rent of £3 10s. 7*d*. per acre in order to get 3.5 per cent. interest.

In connection with these demands of the landowners, the conditions that the farmers can accept will now be examined. The farmers require for themselves and for those members of their families who work in the farm, wages,including food, at least equal to those earned by good permanent farm hands, besides which their capital ought to bring them in an interest of at least 4 per cent.

If these reasonable demands of the farmers be borne in mind, the rents that they could still agree to pay, on the basis of the data supplied by the Secretariat are the following:

Group of Farm	£	s	d	
I.	1	9	0	per acre
II.	1	19	7	»
III.	1	13	0	»
IV.	1	16	6	»
V.	4	5	5	»
VI.	1	19	6	»
VII.		13	0	»

From the above it will be seen that the figures at which the rents cease to be profitable to the farmer are 12*s.* 10*d.* to 17*s.* 7*d.* per acre lower than those demanded by the landowners ; hence the necessity in drawing up a lease between landowner and farmer that each of the parties should surrender some of his demands in order to come to an agreement.

These data, though most carefully calculated, have, however, in practice only the value of indications, even when they concern farms in similar conditions. The limits of mutual advantage will have to be fixed for each single case according to the effective conditions of productivity of the farm itself.

The figures given above show that a rent of £3 10*s.* 7*d.* cannot be *a priori* excluded, as the Secretariat quotes an instance in which a farmer found it profitable to pay a rent of £4 5*s.* 4*d.* per acre. Probably milk farms (Abmelkwirtschaften) near populous centres are in the same condition.

According to the special investigations of the Swiss Peasants' Secretariat, the average rent for the whole of Switzerland appears to be £ 2 0*s.* 1 ¼*d.* per acre, which corresponds nearly to the interest on the value based on returns (Ertragswert) which is stated to be £1 15*s.* 11 ¼*d.* according to an average deduced from 1986 analytical yearly accounts.

1667 – **The Yield of Pastures in the Val d'Aosta.**

GULLINI, PIETRO La produzione dei pascoli Valdostani. — *L'agricoltura italiana*, Year 38, Part 730. Pisa, October 16, 1912.

The direct measurement of the amount of forage produced if obtained by a good number of well chosen test plots under normal weather conditions and distinguished into groups according as to whether they were irrigated or dry and whether they had been manured or not, would afford the best basis for ascertaining the normal quantity produced.

If then this product, on being compared with the data supplied by the science of animal husbandry on the amounts required per unit of live stock, agrees with the actual number of animals kept (which at present is determined empirically by the alpine herdsmen), it may be concluded that the present usual production is duly utilised

The following table (p. 2724) gives some data collected directly by the writer on the production and rent of the pastures he has examined.

The conclusions that may be drawn from it are:

1. That the yield varies from 10.35 to 15.13 cwt. per acre under normal conditions.

2. That according to the pasture, at present from 3.18 to 4.77 cwt. of live weight may be kept per acre.

3. That the amount of live stock actually kept seems to be fairly proportionate to the pasture.

Production and rent of some alpine pastures.

(grazing extends over about 100 days)

Name of the alp	Altitude Feet	Total cattle live weight cwt	Average production of hay cwt per acre	Live weight of cattle cwt per acre	Rent per acre s	d	Profit per acre from transformed production s	d
Boses	5 420	187	14 3	4.8	15	8	11	11
La Valle	4 931	102	10 8	3.3	9	4	15	2
Trucchetto	5 413	102	11.9	3.8	9	10	14	7
Ciapel Brengola . . .	5 768	106	11.7	3.6	9	9	13	7
Colma	6 234	140	11.2	3 6	8	6	15	9
Monegliano	5 676	197	12.9	4 4	10	8	18	3
Truc e Alpetto . . .	5 544	177	12.7	4.0	9	8	17	5
Bechera (*)	6 575	321	8 3	4.3	run by owner		9	7
Monchini	5 850	262	15.2	4.8	12	4	15	7

(*) Stay on the mountain only 62 days.

4. That the rent paid per acre is generally in proportion to the forage produced, except in the case of the Boses pasture in which the rent is above the average.

The milk obtained from these pastures is not worked up collectively, but by each farmer separately.

The dairying industry gives the following results per 100 lb. of milk.

1. Butter from 3.5 to 4 lb.
2. Skim-milk cheese „ 7 to 7.5 lb.
3. Whey cheese (Ricotta) . . „ 1 to 1.5 lb.

On the following page are given the milk returns of the above mentioned alpine pastures.

The average daily production per milch cow is thus about 1.32 gals., which corresponds to the quantity usually considered by practical men to be the yield of pastures in that region.

During the time that the cows are grazing on the Alps they considder the yield to be 2 to 2 1/4 gals. for the first month; 1 1/2 to 1 3/4 gals. the second month; about 1 1/4 the third and about 3/4 the last fortnight.

Name of the alp	Number of milch cows	Total production of pasture gals.	Average daily yield per milch cow gals.
Boscs	16	2 024	1,26
La Valle	10	1 342	1,34
Trucchetto	9	1 089	1,21
Ciapel Brengola	10	1 302	1,30
Colma	12	1 531	1,28
Monegliano	16	1 903	1,19
Truc e Alpetto	15	2 050	1,36
Bechera	32	2 319	1,17
Mondini	23	2 631	1,14

As regards the making of cheese, there is some room for improvement, especially in the hygienic conditions under which it is made and which have so great an influence on the keeping qualities of the product.

AGRICULTURAL INDUSTRIES.

1668 – **The Cooling of Milk in the Stable introduced by the Cooperative Dairy of Soresina.** DAIRYING

BERGAMASCHI and SAMARANI. Il raffreddamento del latte nella stalla introdotto alla Latteria cooperativa di Soresina. — *L'Italia Agricola*, Year XLIX, No 19. Piacenza, October 15, 1912.

The cooperative dairy of Soresina, Cremona, which will soon be in a position to deal with 13 200 gallons of milk per day, introduced last spring the practice of cooling the milk in the stables, and provided 135 of its members residing furthest from the dairy with the necessary water refrigerators in order to cool the milk to 20° C. (68° F.) before putting it into the cans for carriage to the dairy.

When the milk is cooled to 20° C. (68°F.) in the stable, it reaches the dairy even after a two hours journey at a temperature only one or two degrees higher, and with no increase in its bacterial contents.

The very great advantage of cooling the milk at the stable is seen especially in the manufacture of fat cooked-curd cheeses, such as Emmental, Sbrinz, and Cacio Cavallo.

In summer, when the milk is put into the boiler after it has undergone a long journey, the cheese maker must work up the milk very rapidly and this excessive rapidity is injurious to the good quality of the product obtained. As is well known by those who are acquainted with the practical working of a cheese factory, it often happens, in summer, that the last milk that arrives at the dairy, that is the one that has performed the longest journey, is the first to leave the boiler as cheese.

All these inconveniences disappear when the milk to be carted away is first cooled in a good well-water refrigerator to about 20° C. To the refrigerator a milk filter of the Hulax type, with cotton filtering layer must be directly connected. With an average outlay of 100 Lire (about £4) the Cooperative Dairy of Soresina was able to provide the apparatus required for treating up to 110 gallons of milk per diem. Twenty gallons of water at 14° to 15°C. (57° to 58° F.) are sufficient to cool to a proper temperature an equal volume of milk. All the expense that the dairy has entailed upon its members is thus reduced to the cost of raising water from the well to the tank over the refrigerator.

1669 – "Brindza": a Ewes' Milk Cheese made in Hungary.

RODICZKY, FENO. A brindzáról — *Kozelek*, Year 22, No 77, pp. 2658-2659 Budapest, October 5, 1912.

Cheese made from ewes' milk plays a preponderant part in the export of Hungarian cheeses. It is much sought after, not only in Austria, Bosnia, Germany, Rumania, and recently in Russia, but even in the United States. Thus, the export of cheese made from the milk of "Lipto" sheep in 1903 increased the balance sheet of Hungarian commerce by 1 742 664 fr. (£69125).

The ewes' milk cheese, which is known to the Slavs and Valaques of Hungary usually by the name of "brindza," is sold in different forms and under various names. The Valaques, for instance, sell the pressed cheese in gut under the name of "burduf," or Transylvanian cheese, while that preserved in casks of different sizes is usually known as "Lipto" sheep cheese, although it is made in the counties of Zolyomi, Szepes, or in other places in the north of Hungary.

The quality of ewes' milk cheese depends on several factors, amongst which the breed is of chief importance. The best milkers are the Larsac and Frisian breeds. The latter yield, at Breznóbanya, a milk containing 7.9 per cent of fatty substances. The milk of ewes grazing on the fragrant mountain grass is better and has a superior flavour to that given by plain-fed animals. Therefore, the ewes' milk cheese made in spring and autumn on the mountains is preferable to that obtained from ewes which have remained in the plains throughout the summer. Hence, the popularity of "Jasienka," and "Braznika" cheeses, which are delicious pro-

ducts made in the autumn. The quality of the rennet has a certain influence on the cheese, as has the temperature at the time of coagulation. The industry of making cheese from the milk of ewes is a very ancient one in Hungary, but it still retains its primitive simplicity. The preliminary preparation is done entirely by hand, and on the pastures, from the commencement of spring, in little improvised huts called " Kaliba." The first operation is carried out under the superintendence of the " salasnik," the chief organiser. He is a very important person among the shepherds, for as the making of ewes' milk cheese is a co-operative one, it is upon him that the division of the cheeses among the owners of the sheep devolves ; further, if desired, he undertakes the sale of the cheeses to factories.

There are three milkings a day (at 5 a. m., 2 p. m. and 7 p. m.) and the milk is mixed. After the rennet has been added (10 oz. of rennet in 25 gallons of milk) the milk is stirred continuously at 28-34°C. for 20 minutes. The curd is allowed to settle for 15 to 20 minutes ; then it is put into a cloth, which is suspended to hasten the draining. All these manipulations do not take more than 1 to 1½ hour. The mass of curds, compressed into a ball, is then put on a board in the hut.

In summer, the cheese can be eaten fresh after 2 or 3 days ; in autumn and spring, it takes at least a week before it is fit for consumption. The first stage in the cheese-making is done by the shepherds themselves on the pastures. The subsequent treatments is carried out at the farm, but most of the balls of cheese are sent to factories, where the product is unfortunately adulterated. The writer considers this could be avoided in co-operative cheese factories set up by the owners of the sheep.

1670 – **A Milk Ferment causing Ropiness : *Bacillus casei filans.***

GORINI, COSTANTINO. Di un fermento lattico filante (*Bacillus casei filans*). — *Atti della Reale Accademia dei Lincei*, Year CCCIX, Fifth Series, Vol. XXI, Part 7, pp. 472-474. Rome, October 13, 1912.

According to the writer, lactic ferments differ from each other more in their physiological than in their morphological properties, and it is a serious error to think that the former are connected with the latter. Thus, whilst some authors consider that lactic ferments in the shape of cocci appear to differ from lactic bacilli in the temperatures they prefer and in the degrees of acidity they produce, etc., the writer has found some lactic cocci which prefer more heat and produce more acidity than lactic bacilli, and viceversa. It is therefore necessary, for the identification of a lactic ferment, not to stop at a simple indication of its form, assuming that in its functions it behaves like other morphologically similar lactic ferments; but to study it also in its physio-chemical activity. Now the study of the differentiation of lactic ferments according to their action upon milk has hardly been begun.

The writer has already demonstrated that the above ferments may be divided into two physiological groups: the one consisting of bacteria which display only an acidifying action on milk, for which reason they are to be considered as simple ferments of lactose; the other of bacteria, which besides the acidifying power possess proteolytic properties, wherefore they are to be considered as mixed ferments of lactose and of casein. To each group both cocci and bacilli belong. The lactic-proteolytic ferments in their turn belong to two types: one which reveals its proteolytic power also in gelatine cultures and the other that does not.

The present paper is a new contribution to the knowledge of the action of lactic ferments, as it describes a type of ferment that the writer has isolated from grana cheese (Parmesan) and which has the property of rendering milk ropy. He has cultivated the ferment in question by means of weekly and fortnightly transplantations continued for ten years; he has thus verified that the power of producing ropiness has always been maintained even in pure cultures and in sterilized milk (in autoclave at 120° C. for 20 minutes) without the bacillus ever showing signs of morphological degeneration or of physiological attenuation. The ropiness that it produces in milk lasts only up to the first stages of coagulation, and diminishes and disappears with the progress of the curdling process and contemporary acidification of the milk. In other words the property of the bacillus of inducing ropiness shows itself only in the first periods of its development. The optimum temperature is 42° to 45° C.

Description: Bacilli with rounded extremities, average length 7 to 9 μ, average width 0.8 μ, often diplobacilli; sometimes long filaments; colourable with aniline colours and with Graham's method; often with endo-granulations; immobile; not sporogenous; facultatively anaerobic. In milk cultures at 42° to 45° C. after 6 or 7 hours it begins to produce a slight ropiness; after 9 to 10 hours coagulation sets in attaining an acidity equal to 18 to 22 degrees Soxhlet (18 to 22 cc. of quadrinormal caustic soda per 50 cc. of milk culture). The exceptional fermentative power — for common lactic ferments require from 15 to 24 hours to curdle milk under optimum conditions — excludes the hypothesis that the bacillus is physiologically attenuated. For this micro-organism which is characterized by a high degree of virulence and by the transitory power of producing ropiness, the writer proposes the name of *Bacillus casei filans*. He proposes to deal in another paper with the connection between this lactic ferment and the practice of cheese making.

1671 - New method of Preserving Meat.

DEMOLIN, M. La conservation de la viande par le froid. — *Annales de Gembloux*, Year 22, No. 10, pp. 518-586. Bruxelles, 1912.

Charles Tellier invented a few months ago a method for preserving meat which will before long considerably diminish the importance of the present systems of cold-storage, which have the drawback of a very limited production, because it is much easier to produce economically calories than units of cold, which, as stated by L. Lefebre cost according to conditions of temperature from 5 to 50 times as much as the calories supplied to the machine.

The new invention is based on the fact that when the water that enters into the composition of meat is caused to evaporate, the organic liquids are concentrated to a point at which bacteria do not develop except with great difficulty. Besides, all the surface of the meat exposed to evaporation gets coated with a gelatinous film that preserves it from further contact with micro-organisms.

The evaporation of water is obtained in a vacuum apparatus in which towards the end of the operation both low pressure and temperature act together to desiccate only the surface of the meat.

The animal as soon as it is slaughtered is cut up, the glands and vessels that would not easily dry are removed and the pieces of meat, placed on small trucks, are introduced into the autoclave in which a vacuum is formed. After a certain quantity of water has evaporated, ozone is admitted, as a sterilizing agent. The vacuum is then increased, the temperature being kept between 15° and 25° C. After 20 hours the loss of water has caused the meat to lose about 20 per cent. of its original weight, if the pressure within the autoclave has been reduced to 10 mm. of mercury. The treatment is then stopped and the pressure inside the apparatus is allowed to return to the usual atmospheric pressure, either by admitting sterilized air or some inert gas such as carbon dioxide.

The importance of this industrial process is shown by the following figures:

No. 1.	The fresh meat contained	0.153	grams	of	ammonia	per	kg.			
No. 2.	The vacuum treated meat	0.140	„	„		„	„	„		
No. 3.	„ „ „ „	0.150	„	„		„	„	„		

The quantity of ammonia does not therefore increase, and further, the meat preserved by the new process does not differ in its composition from fresh meat and has very nearly the same appearance, because though the outside is covered by a thin protective film the inside remains fresh and bleeding. Its taste is also good.

In conclusion the advantages of the new process may be summed up as follows:

1. There is practically no limit to the production, as there is in the case of cold stored meat, because the works can be established in each breeding centre.

2. The cost of the upkeep of the railway trucks is substantially reduced as no specially built trucks are required.

3. The cost price of the meat treated by the new process is inferior to that of cold stored meat, because the meat is treated in the centres of production where the animals cost much less than they do in Europe, and also because the expenses of the treatment do not exceed 16 shillings a ton including general expenses.

4. This new method allows of fresh meat being easily stored in the markets and of great provisions of meat being collected for the use of armies in the field.

WINE-MAKING

1672 – **Analysis of the Wines of Drâgashani, Rumania: Vintage of 1911.**

NICOLAU, CATHERINE. Analyse des Vins de Dragashani, Récolte de 1911. — *Annales des Falsifications*, Year 5, No. 47, pp. 422-423. Paris, September 1912.

The district of Drâgashani, situated in Velcea, the northern portion of Oltenie, the west part of Rumania, has given its name to one of the most important vine regions for the production of white wines. The Drâgashani vineyards lie in the Olt valley, and principally in the valley of Dealul Oltului, where the best wines are produced. Most of the vineyards are on Pleistocene alluvium. A yellow, siliceous clay mixed with gravel is the base of nearly all the vine soils. Lime occurs in the proportions of 0.2 to 3.4 per cent. as a rule; sometimes, but rarely, it reaches 20 per cent.

The principal vine-growing districts, which form as a whole the vine-region of Drâgashani are as follows: Dealul Nisipoasa, Cretzeni, Mitrofani, Orbesti, Prundeni, Isvorul and Nemoiul.

Composition of Drâgashani Wines.

	Density at 15° C	Alcohol % in volume	Dry extract at 100° C	Mineral matter	Total acidity as H_2SO_4	Volatile acidity as H_2SO_4	Fixed acidity as H_2SO_4	Phosphoric acid	Total tannic acid	Reducing sugars	Glycerine	Ratio alcohol to glycerine	Total alcohol + fixed acidity	Halphen ratio
Average.	0.9954	11.94	23.45	2.14	4.41	0.68	3.72	0.31	1.98	2.34	6.66	7.32	15.66	0.37
Minimum. . . .	0.9916	10.52	17.16	1.21	3.52	0.45	2.92	0.19	1.43	0.78	5.32	5.03	13.74	0.28
Maximum. . . .	1.0112	13.72	39.83	2.94	5.48	0.89	5.03	0.52	4.01	8.50	7.99	11.01	17.89	0.48

In order to give some idea of the composition of the wines of this country, we reproduce some figures from the table furnished by the analysis of 40 samples taken by the writer directly from the vineyard. The accompanying table gives the average composition of 12 samples of white wine taken in the district of Dialul Oltulin and of the minimum and maximum quantities of the substances which enter into the composition of these wines (the figures are in grams per litre except where otherwise stated).

1673 - **Maraschino, Maraschino Brandy and "Eau de Marasque".** DISTILLING

BONIS, A. Le Marasquin, l'Eau-de-Vie de Marasque, l'Eau de Marasque. — *Annales des Falsifications*, Year 5, No. 47, pp. 413-417 Paris, September 12, 1912

The marasca, which is a variety of wild cherry indigenous in the mountains of Dalmatia, is used for the manufacture of a sort of cherry liqueur called maraschino of which the centre of production was originally the district of Zara. At present, these cherries are grown and maraschino is made, in other countries, notably in Italy, Greece, and France, where the industry is chiefly localised in the neighbourhood of Grasse.

In France, the name "Marasquin" is used chiefly for a liqueur, which is made by the sweetening of maraschino brandy, with or without other scents (essence of kernels, essence of orange-blossoms, jasmine extract, vanilla extract)

In the neighbourhood of Grasse, the cherries are crushed and then left for alcoholic fermentation to take place. When this has finished, the product is distillled. The process of distillation is carried out in two different ways:

1. The portions rich in alcohol are alone selected, and from these is made maraschino brandy, or spirit of marasca, with an average of 40° to 50° of alcohol.

2. The largest possible amount of the distillate is taken to produce "eau de marasque," which has an alcohol content of from 8° to 15°.

In the neighbourhood of Grasse, about 100 tons of marasca cherries are gathered annually; from these from 2500 to 3000 gallons of maraschino brandy can be made.

From the enquiry lately made in this district, it appears that the present production of maraschino brandy is very small, or even nil, the whole crop of cherries being made into "eau de marasque."

The samples received by the writer, and which were analysed in the Central Laboratory for the Repression of Fraud, are all of a low degree of alcoholic strength (from 5° to 19°). One of them, though called "spirit of marasca," has only 19°, and thus corresponds rather to "eau de marasque," which seems to show that preference is given at present to the second method of distillation mentioned above, in order to obtain from the cherries used, the greatest possible quantity of scented liquid.

ADULTERATION OF FOODS

1674 - International Agreement upon the Bases of the Measures for Regulating the Importation of Foodstuffs in general and especially of Dairy Produce.

MENOZZI, ANGELO. Intesa internazionale per le norme che devono regolare le disposizioni regolamentari, igieniche e chimiche sull'importazione dei prodotti alimentari in genere e caseari in ispecie. — *Bollettino dell'Associazione Agraria Friulana*, Year 57, Series VII, Vol. 29, Nos. 9-18, pp. 247-250. Udine, September 30, 1912.

"The legislation which regulates the trade in foodstuffs does not only vary from one country to another, but the methods of analysis and the standards adopted in judging the qualities of the same ware are also different. It follows then, that goods that are considered genuine or declared marketable in one country are judged differently in another, in which their sale may even be prohibited. So long as the trade is limited to the interior of a State not much harm is done, but every one will perceive what inconveniences this state of things causes to international commerce.

"A few examples will suffice to illustrate the present situation and the evils to which it gives rise.

"The maximum amount of water allowed in butter declared to be marketable is not the same in the different countries. In some, the highest limit is 16 per cent., in others 15, in others again 18. Italian butter for instance is refused by Swiss merchants, or paid a lower price if it contains upwards of 16 per cent. of water, which is the limit fixed by legislation in Switzerland.

"Italian legislation does not fix directly the water content, but limits it indirectly by providing that butter must contain 82 per cent. of fat. This means that if the solids-not-fat represent only 1 per cent., as is the case with well worked butter, the butter satisfies the requirements of Italian legislation if it contains 17 per cent. of water, whilst it does not conform to the Swiss standard.

"Also in the quantity of solids not fat (curd, salts, milk-sugar) there should be agreement. Some limit these substances at 1 per cent., others at 2.

"The methods followed in the various countries to ascertain the genuineness of butters, that is, to decide whether they have been adulterated or not with foreign fats, are not absolutely identical; in Italy the chief determinations concern the titration of volatile acids, the index of refraction, and the examination under the polarising microscope. In other countries the examination under the microscope is left out and replaced by the specific gravity at 100°C. In Germany the law requires sesamum oil to be added to margarine with the object of following and recognizing it in its admixtures; in France they want to introduce the same measure and to refuse admittance to the butter from those States which do not adopt identical measures.

"Difference of treatment is also meted out to preservatives. In England the addition of boric acid up to a maximum of 1 per thousand, and of borax is allowed. The Italian law permits the addition of borax up to 3 per thousand, but forbids the use of boric acid. Other countries do not tolerate any preservative at all. These differences in the laws and regulations of the various countries may occasion most serious difficulties to international transactions.

"In regard to cheeses, thedifficulties caused by the disparity of judging and of treatment are well known to Italian exporters. It will be sufficient to recall the case of Gorgonzola cheese. As this is a soft cheese, the makers have for many years past adopted the system of encasing it in a coating which allows the ripening to be regulated and protects the cheese during transport so that even in summer it does not lose its shape. This coating was at first prepared with brickdust and fat or oil, and afterwards with heavy spar (barium sulphate).

"Against the use of barium sulphate the French were the first to raise objections on the ground of its being a poisonous substance. To this it may be observed that the heavy spar is in the coating which is not eaten, and that it is insoluble. But one can easily understand that it is an argument of a certain weight with those whose interests are opposed to those of the cheese makers, all the more so as a danger, from the sanitary point of view, can not be absolutely denied.

"For these reasons the cheese makers and preparers of Italian Gorgonzola were advised to abandon barium sulphate in the composition of the coating.

"Meanwhile a serious opposition arose in England. The barium compounds in the coating having been abandoned, it was said on the London market that the mere presence of a coating was a commercial fraud, especially as its weight attains, according to the English merchants, a considerable proportion of the total weight of the cheese. It was justly answered that the coating is considered as tare and as such is deducted from the weight or from the price, but the opposition continued and led the London trade to consider cheese enclosed in a coating as adulterated.

"The Italian Ministry of Agriculture has tried to remove these difficulties, on the one hand by means of the opinions of experts, on the other by advising exporters to refrain from using anything that is not strictly necessary in the making of Gorgonzola, and thus to avoid the opposition and the protests which have been raised in foreign markets against this product. But many difficulties still remain.

"All these difficulties would disappear if an agreement were come to on the following points: In a cheese like gorgonzola, is a coating of absolutely inert substances to be allowed or not? and in the affirmative, up to what limit?

"Similar questions have arisen about another very important Italian cheese, the Grana or Parmesan: according to recent legislation in the United States of America on food stuffs, it was demanded that Grana cheese, in order to be admitted into the States, should be declared as a cheese prepared from partly skimmed milk.

"Though this declaration is a true statement, it is a fact that it is liable to bring discredit on the product. Grana cheese has been prepared for centuries according to a well known process and it possesses a certain composition; it would therefore be better to demand that Grana in order to be admitted into trade should conform to certain conditions of shape and chemical compositon.

"The same for the Roman Pecorino (ewe's milk cheese). Basing the opposition on erroneous data it was argued that the Pecorino and all its varieties and compositions as prepared in Latium was not genuine ewe's milk cheese, and it required a whole series of analyses to prove that the opposition in America to this Italian cheese was unjustified.

"The same conditions prevail in the wine trade. Not only do the methods of analysis differ in the various countries, but even the very fundamental principles of judging of the genuineness of wines are not the same in Germany, in Switzerland, in Austria-Hungary, in Italy. It thus happens that an Italian wine having a certain chemical composition is admitted into Austria-Hungary as a genuine wine, whilst it is refused admittance into Switzerland and perhaps Germany also, on the plea that it is not genuine, and this on account of the different limits adopted by the various States for extractive matter and ash, and for the ratios between the several components of a wine.

"The same may be said for oils and for preserved foods, in which international transactions, on a great scale, are frequent.

"It may seem strange that for such important staples as those above mentioned there should be so much disagreement between the various States, whilst for other wares there are standards and methods of analysis which have been adopted by the whole world.

"Manures, basic slag for instance, as well as phosphates and nitrates, are examined according to internationally recognized methods. When for instance the total phosphorus pentoxide of basic slag is mentioned, everybody understands that the determination has been made according to a certain method. When a degree of fineness is spoken of, it is understood that it is obtained with a certain sieve (Kall No. 100) used in a particular way and for a specified time.

"It will be necessary to come to some similar system for foodstuffs also, especially for those which form the object of international commerce.

"As in general the methods of analysis are not absolute, but conventional, it will be necessary, if uniformity of results is to be attained, to

follow the same methods and to apply them in the identical manner; In the same way it will be necessary to come to an agreement on the standards, on the limits of composition, etc., so that the staples may correspond to certain qualities.

"At every international congress of applied chemistry the subject is discussed and steps have been proposed; but hitherto both discussions and proposals have remained without effect. Every State keeps to its official methods of analysis and to its standards.

"In order to arrive at a practical result the various States should entrust a conference of experts with the task of uniforming methods of analysis and standards, engaging themselves, when an understanding had been reached, to adopt its results in their legislative measures.

"Whilst an agreement among the various States with the object of disarming or of limiting armaments savours of Utopia, an understanding in the peaceful field of industry and of commerce ought to be easily attained."

Already in many other industrial and social questions an agreement has been possible, and the writer hopes that in this question also the same will be the case; he concludes by expressing the wish "that the initiative of this agreement be taken by the International Institute of Agriculture or by the Italian Ministry of Agriculture, Industry and Commerce."

PLANT DISEASES.

GENERAL INFORMATION.

1675 - **The Law of May 17, 1912 (No. 81), Applicable to the Archduchy of Lower Austria; Relating to the Protection of Crops from the Attacks of Injurious Insects.**

Landes- Gesetz und Verordnungsblatt, No. XIX, p. 107. 1912.

On the proposal of the Diet, the Archduke of Lower Austria has decreed as follows:

Art. 1. — All occupiers of land (owners, farmers, usufructuaries, etc.) are required to destroy, within the period allowed by the Comittee, and at the times fixed by them, such insects as are injurious to cultivated plants, together with the eggs, larvae (caterpillars) and cocoons of the same. Their collection and destruction should be carried out in the course of all agricultural work. If infected trees are felled, or their branches lopped, the insects must be destroyed.

Art. 2. — The same interested persons (Art. 1) are required to collect cockchafers during the period of their flight and to destroy them wherever they may be found.

The owners of forests must either hold themselves responsible for the cockchafers on the borders of their woods, which are contiguous to cultivated fields within a maximum radius of 65 ft., or allow their woods to be entered for the purpose of destroying these insects. Outside this radius, the duty of discovering cockchafers devolves upon the Communal Assemblies in cooperation with the owners of the woods.

Art. 3. — The premiums, of which the amount is fixed by the Communal Assembly, due regard being paid to local circumstances, are paid out of the communal funds. The Provincial Comittee gives grants to the communes to defray a portion of this outlay. In the case of the distribution of the premiums, the place and the number of the cockchafer depôts is to be determined by the Mayor.

Art. 4. — The Regency of Lower Austria, in cooperation with the Provincial Committee, will make known by means of a decree, the mea-

sures to be taken for the control of the insects mentioned in Art. 1, notably in cases where these are effecting real damage, in order that a plan of control may be organized by the communes, and when new unknown insects have made their appearance in the district, or fresh control measures are discovered.

Art. 5. — It is the duty of the Mayor to see that the persons mentioned in Art. 1 discharge the obligations laid upon them by the present law everywhere, at the time required and in a complete manner; in all cases where the destructive measures have been omitted, he is to take the steps necessary for their being carried out at the expense of the defaulting persons.

The Mayor is required to inform the chief Government Official of such persons as have neglected this duty.

Art. 6. — The chief Government Official is empowered to fine all such persons from 5 to 100 crowns (4*s.* to 4 guineas); this sum being given to the funds for the poor of the district. Should the offenders be insolvent, the fine is commuted to an equivalent term of imprisonment.

Art. 7. — The work of destruction and the protective measures imposed by the present law must be executed by the Commune at its own expense, in so far as concerns the property of the Commune. If, in spite of a demand in due form of law, the Communes do not discharge this duty, the said district official is to carry out the work at the expense of the Commune interested.

Art. 8. — The Mayors must publish twice a year, at the beginning of the months of March and September, the present law, together with the decree for its execution elaborated according to Art. 4. The Government Official shall summon the Mayors and give them their instructions when required.

Art. 9. — Such Mayors as show negligence in the performance of the obligations laid upon them by the present law, or who in any way fail in the observance of the latter, will be subject to a disciplinary fine of from 20 to 50 crowns (16*s.* 8*d.* to 2 guineas) imposed by the Government Official, and which will be devoted to the poor fund of the district.

Art. 10. — The superintendence agent, deputed to protect the different branches of agriculture, is required to inform the Mayor (or, should the latter be at fault, the Government Official of the district) of any infringement of the above law, which has come under his notice.

Art. 11. — The general regulations relating to the procedure of the penal code are here applicable as regards the power of the authorities to seek out and punish infringements of the present law as well as regards cases of trangression and postponement.

Art. 12. — The present law leaves entirely untouched the provisions of the Forestry Law (letters patent of Dec. 3, 1852, *Journal des Lois d'Em-*

pire, No. 250) which deal with the destruction of insects which injure the forests, and also the provisions of the laws of April 3, 1875 (*Journal des Lois d'Empire* No. 61) and of June 27, 1885 (*Journal des Lois d'Empire*, No.3 of 1880) relating to the measures necessary to control the spread of phylloxera (*Phylloxera vastatrix*).

Art. 13. — The present law, the execution of which is entrusted to the Ministers of Agriculture and the Interior, will come into force on the day of its publication. From this date, the laws of Dec. 10, 1868 (*Journal des Lois provinciales*, No. 4 of 1869), relating to the protection of crops from the ravages of caterpillars and cockchafers, and that of Aug. 26, 1899 (*Journal des Lois provinciales*, No. 72), dealing with the measures of removing and destroying the woolly aphis of the apple tree (*Schizoneura lanigera*), are abrogated.

1676 - **Destructive Insects and Pests scheduled by the Board of Agriculture and Fisheries.**

LONG, H. C. in *The Gardener's Chronicle*, Vol. [III,] No. 1344, pp. 241-242. London, September 28, 1912.

So long ago as 1877, Great Britain was alarmed by the advent of the Colorado beetle (*Doryphora decemlineata*) which proves a great scourge of potatoes in the United States of America. Provision was at once made by the Colorado Beetle Order, 1877, to stamp out the infestation, and its eradication was successfully accomplished by the Agricultural Department of the Privy Council — now the Board of Agriculture and Fisheries. This beetle, therefore, has never become established in Great Britain, though it again entered the country in 1901, when it was found near Tilbury, but was dealt with quickly and satisfactorily.

The widespread damage done by insect and fungous pests has of late years assumed such significance that it has been more and more realised that official action is necessary to cope with such pests and to control their distribution. The question came before Parliament in 1907, when the old Act of 1877 was extended, and the Destructive Insects and Pests Acts, 1877-1907, now enable the Board of Agriculture and Fisheries to deal drastically with these problems. In the past five years the Board have made several Orders, making the presence of certain pests on the farm and in the garden notifiable, with penalities for non-compliance. Further, the Orders render certain action compulsory in the case of the scheduled insects and pests.

At the present time four main Orders are in force.

(*A*) Under the Destructive Insects and Pests Order, 1910, are scheduled :

The Narcissus Fly (*Merodon equestris*, Fabricius).

Wart Disease or Black Scab of Potatos (*Synchytrium endobioticum*, Percival).

The Vine Louse (*Phylloxera vastatrix* Planchon).

The San José Scale (*Aspidiotus perniciosus*, Comstock).

The Mediterranean Fruit Fly (*Ceratitis capitata*, Wiedemann).

The Colorado Beetle (*Doryphora decemlineata*, Say).

The Large Larch Sawfly (*Nematus erichsonii*, Hartig).

The Potato Moth (*Lita solanella*, Boisduval).

The Gipsy Moth (*Liparis* [*Ocneria*] *dispar*, Linné).

The Brown Tail Moth (*Euproctis chrysorrhœa*, Linné).

The Nun Moth (*Liparis monacha*, Linné).

The Cherry Fly (*Rhagoletis cerasi*, Linné).

Black Knot (*Plowrightia morbosa*, Saccardo).

Tomato Leaf Spot (*Septoria lycopersici*, Spegazzini).

Melon or Cucumber Canker (*Micosphœrella citrullina*, Grossembacher).

American Pear Blight (*Micrococcus amylovorus*, Burrill).

(*B*) Under the American-Gooseberry-Mildew-Order of 1911 is scheduled the American Gooseberry Mildew (*Sphœrotheca mors-uvæ*).

(*C*) Under the Wart Disease of Potatos Order of 1912 Wart Disease of Potatos is removed from the Order of 1910 and given an Order to itself.

D) The American Gooseberry-Mildew (Fruit) Order of 1912 regulates the sale and importation of Gooseberries.

A) The Order of 1910 states:

1. — The occupier of any premises on which an insect or pest mentioned in the Schedule to this Order exists, shall forthwith notify the fact, with particulars of the time and place of discovery, to the officer appointed by the Local Authority to receive such notices, or, if no such officer has been appointed, to the Board; and, where practicable, a specimen of the insect or pest shall accompany the notice.

2. — An inspector or other officer appointed in that behalf by the Local Authority and any inspector of the Board may, upon production, if so required, of his appointment or authority, enter any premises on which he has reason to believe that an insect or pest mentioned in the schedule to this Order exists or has recently existed, and examine any plant, fruit, crop, seeds, tubers, bulbs, layers or cuttings on such premises.

4. — Every person who shall knowingly use, or sell for use, for planting any plant, seed, tuber, bulb, layer or cutting attacked by an insect or pest mentioned in the schedule to this Order, or any seed, tuber, bulb, layer or cutting which has been derived from a plant so attacked and is capable of spreading the insect or pest, shall be liable on convinction to a penalty not exceding £10.

5. — It shall not be lawful, except with the written permission of the Board, to import, sell, or offer for sale a living specimen of any insect or pest mentioned in the schedule to this Order.

B) The Order of 1911 specifies as follows :

3. — The occupier of any premises on which there is a bush* which is, or appears to be, diseased shall forthwith notify the fact by post or otherwise to the Board, or to the clerk to the Local Authority, or to an inspector of the Board or of the Local Authority, and where practicable a specimen showing the disease shall accompany the notice.

This Order further requires that no bush shall be moved from any garden in which disease exists or appears to exist until after an investigation by the Local Authority, who may at any time and from time to time, by a notice served on an occupier of infected premises, require him to adopt such measures for prevention of the spread of the disease as are also authorised by the article and specified in the notice.

The landing in Great Britain of any bush brought from any place out of Great Britain (except the Channel Islands) is prohibited, except that this provision does not apply to the landing of any Currant bush under the authority of a licence anthorising such landing previously obtained from the Board of Agriculture and Fisheries.

C) The Wart Disease of Potatos Order of 1912 provides in the same way as the other two for notification of the existence of the disease, and orders that no tubers shall be removed from any premises on which the disease exists or appears to exist until after investigation by the Local Authority, who are empowered to prohibit the planting of potatos in the infected premises except under prescribed conditions. It is further provided :

« 8. It shall not be lawful to use any diseased tubers for planting, or to sell or offer for sale diseased tubers for that purpose, and an inspector of the Local Authority acting under their directions may, by a notice served on the occupier of any infected premises, prohibit the removal of any tubers from the infected premises, except under such conditions as the inspector acting under such directions may consider necessary to prevent any diseased tubers being so used or sold or otherwise disposed of for planting ».

D) The American Gooseberry-Mildew (Fruit) Order of 1912 prohibits the sale or exposure for sale of diseased Gooseberries, and further prohibits the importation of Gooseberries from any place outside Great Britain (except the Channel Islands), except when the package is labelled

* " Bush " is defined as a Gooseberry bush or Currant bush, and includes a cutting, stock, or seedling, and any part of the bush except the fruit. (*Author's note*).

« Imported Gooseberries » and bears the name of the consignor and the country and district of origin. Cleansing of packages which have contained diseased Gooseberries is also provided for.

All the Orders provide a penalty not exceeding £10 in the case of persons convicted of an offence under the Orders.

BACTERIAL AND FUNGOID DISEASES

FUNGI

1677 - Cultures of Heteroecious Rusts.

FRASER, W. P. in *Mycologia*, Vol. IV, No. 4, pp. 175-193. Lancaster, Pa., 1912.

The cultures described in the paper under review were undertaken during the spring and early summer of 1911. Special attention was given to the study of the aecia on conifers and their connection with telial forms, but a few cultures of the grass and sedge rusts were also tried. The teliosporic material used in the cultures was collected in the district surrounding the town of Pictou, Nova Scotia. The experiments were carried on in a laboratory of Pictou Academy and at the Agricultural College, Truro, N. S.

When the host plants were ready for infection, the leaves or parts of the plants bearing telia were placed in a moist chamber on damp blotting paper and then sprayed with water. Then the germinating teliosporic material was suspended above the host plants so that the basidiospores would fall on the leaves; the whole was then sprayed by an atomizer and covered for one to several days with a bell jar. In some cases five to seven days were required for germination, in others a day or less was sufficient. The teliospores of the *Melampsoropsis* rusts, which mature and germinate on the living host plants in the spring, were collected when germinating, or the mature telia were placed immediately after collection in a moist chamber until they germinated freely, which usually took place in about twenty - four hours.

The following cultures have been undertaken and are described:

1. Life histories supplementing previous work of the writer or other investigators.

Pucciniastrum pustulatum (Pers.) Dietel. Teliospores from *Epilobium angustifolium* L. infected *Abies balsamea* (L.) Mill. Aeciospores from *Abies balsamea* infected *Epilobium angustifolium*, L.

Calyptospora columnaris (A. & S.) Kuehm. Teliospores from *Vaccinium pennsylvanicum* Lam. infected *Abies balsamea* (L.) Mill.

Melampsoropsis ledicola (Peck) Arthur. Teliospores from *Ledum groendlandicum* Oeder infected *Picea canadensis* (Mill.) BSP.

Melampsoropsis Cassandrae (Peck & Clinton) Arthur. Teliospores from *Chamaedaphne calyculata* (L.) Moench. infected *Picea rubra* (Du Roi) Dietr. and *Picea mariana* (Mill.) BSP

Melampsoropsis abietina (A. & S.) Arthur. Teliospores from *Ledum groendlandicum* Oeder infected *Picea rubra* (Du Roi) Dietr.

Uromyces Scirpi Burr. Teliospores from *Scirpus campestris* var. *paludosus* (A. Nelson) Fernald infected *Cicuta maculata* L.

Uromyces Peckianus Farl. Teliospores from *Distichlis spicata* (L.) Greene infected *Atriplex hastata* L., *Chenopodium album* L. and *Salicornia europea* L.

Uromyces perigynius Halst. Teliospores from *Carex deflexa* Hornem. infected *Solidago bicolor* L. Teliospores from *Carex scoparia* Schkuhr. infected *Solidago graminifolia* (L.) Salisb. and also *Aster (puniceus ?)*.

Puccinia perplexans Plow. Teliospores from *Alopecurus pratensis* L. infected *Ranunculus acris* L.

Puccinia albiperidia Arth. Teliospores from *Carex intumescens* Rudge, *Carex debilis* var. *Rudgei* Bailey, and *Carex crinita* Lam. infected *Ribes prostratum* L'Hér. and teliospores from *Carex crinita* Lam. and *Carex arctata* Boot. infected *Ribes oxyacanthoides* L.

Puccinia Caricis-solidaginis Arth. Teliospores from *Carex scoparia* Schkuhr. infected *Solidago graminifolia* (L.) Salisb. and from *Carex stipata* Muhl. infected *Solidago (rugosa?)*.

Pucinia Caricis-Asteris Arthur. Teliospores from *Carex trisperma* L. infected *Aster acuminatus* Michx.

II. Life histories worked out for the first time.

Necium Farlowi Arth. Teliospores from *Tsuga canadensis* (L.) Carr. infected the same species.

Melampsoropsis Pyrolae (DC) Arth. Teliospores from *Pyrola Americana* Sweet and *Pyrola elliptica* Nutt. infected cones of *Picea canadensis* (Mill.) BSP. (*Peridermium conorum-Piceae* (Rees) Arthur).

Pucciniastrum minimum (Schw.) Arthur. Teliospores from *Rhodora canadense* (L.) BSP. infected leaves and cones of *Tsuga canadensis* (L.) Carr. (*Peridermium Peckii* Thüm.)

Uromyces Spartinae Farl. Teliospores from *Spartina Michauxiana* Hitch. infected *Arenaria lateriflora* L. but failed to infect *Spergularia canadensis* (Pers.) Don. Teliospores from *Spartina patens* (Ait.) Muhl. and *Spartina glabra* var. *alterniflora* (Loisel) Merr. infected *Spergularia canadensis* but failed to infect *Arenaria lateriflora* L.

Melampsora arctica Rostr. Teliospores from *Salix discolor* Muhl. infected *Abies balsamea* (L.) Mill.

Melampsora (Medusae Thüm ?). Teliospores from *Populus grandidentata* Michx. infected *Tsuga canadensis* (L.) Carr. (*Cacoma Abietis-canadensis* Farl.)

1678 – **Correlation between certain Species of *Puccinia* and *Uromyces*.** ORTON, C. R. in *Mycologia*, Vol. IV, No. 4, pp. 194-204 + plates 70 and 71. Lancaster, Pa., 1912.

One of the taxonomic problems which have arisen in the work of preparing the Uredinales for *North-American Flora* is that of the relationship existing between *Puccinia* and *Uromyces*. Certain species in the two genera are conspicuous because of their apparent morphological similarity and of their occurrence upon the same or closely related hosts in both gametophytic and sporophytic stages; further, in most cases the correlated species have a similar geographical distribution.

For the purpose of a better understanding of the taxonomic development of these genera, the writer gives a brief statement of the treatment of *Uromyces* and *Puccinia* by the leading workers on the rusts, from Person's time to the present.

The present paper is the first attempt to list the correlated species in *Puccinia* and *Uromyces* and is limited to a discussion of a few of the more prominent types of correlation in the long cycle forms only.

In the spring of 1910 Mr. W. P. Fraser of Pictou, Nova Scotia, made sowings of teliospores of *Uromyces Peckianus* Farlow on *Atriplex patula* and *Chenopodium album*, both of which produced infection and formed aecia of the same type as those of *Puccinia subnitens* Diet. on the same hosts. This result led to a careful comparison of the two rusts with results as follows: *Puccinia subnitens* Diet., is a rust on *Distichlis spicata* (L) Greene and has its aecia on a large number of Chenopodiaceous, Capparidaceous and Cruciferous hosts. The aecia of *Puccinia subnitens* Diet. and those of *Uromyces Peckianus* are identical in all discernible morphological characters; further teliospores of the two rusts possess no differential characters except numbers of cells and consequent size. *Uromyces Peckianus* is known only from the coastal regions, while *Puccinia subnitens* is an interior form; hence it seems probable that the one-celled form is less adaptive to varying conditions of soil and temperature than the two-celled form and so has been unable to thrive in the interior.

Other undoubtedly correlated species are a *Puccinia* passing under several names (*P. Caricis-Asteris, P. Caricis-Solidaginis, P. Caricis-Erigerontis*) on various species of *Carex*, having aecia on *Aster, Solidago, Erigeron*, and close relatives, and *Uromyces perigynius* Hals. (*U. Caicina* E. and E.) on several species of *Carex*, which is known to have its aecia on *Solidago* and *Aster*. The aecia and the urediniospores of the two species appear identical, the teliospores differ only in the number of cells. The geographical distribution is practically the same; three of the telial hosts, *Carex intumescens* Rudge, *C. scoparia* Schk, and *C. tribuloides* Wahl. are the same for both species.

Puccinia Ellisiana Thüm., is apparently correlated with *Uromyces pedalatus* (Schw.) Sheldon. The telial hosts of the latter are restricted so far to *Andropogon glomeratus* (Walt) B. S. P. and A. *virginicus* L., while the telial hosts of *Puccinia Ellisiana* include in addition *Andropogon furcatus* Muhl. and *A. scoparius* Michx. with a further extending northern range. The greater adaptability of the two-celled form results in a wider range of hosts and distribution.

In 1901 a rust was reported on *Carex pubescens, Puccinia albiperidia*, possessing urediniospores with the marked morphological character of one basal pore. Very recently, however, it has been found that in every case where the species has been cultured on *Ribes* urediniospores

could be found which were morphologically identical with the urediniospores of the common gooseberry-currant rust of Europe and America. Hence the common form has been responsible for this particular rust, for which the writer proposes the name *Puccinia uniporula*. So far, it has been detected on 7 species of *Carex*. The writer connects this rust with *Uromyces uniporulus* on *Carex gracillima* Schw. and *C. tenuis* Rudge, both of which are also telial hosts of *Puccinia uniporula*.

From the rust of *Spartina* three forms of *Uromyces* have been separated, having aecia on members of the *Caryophyllaceae*, *Primulaceae* and *Polemoniaceae* respectively. The form of *Uromyces acuminatus* Arth. having aecia on *Steironema ciliatum* (L). Raf. and telia on *Spartina gracilis* Trin. and *S. Michauxiana* Hitch, is evidently correlated with *Puccinia Distichlidis* E. E. having aecia on *Spartina gracilis* (and not on *Distichlis maritima* as was erroneonsly described).

Puccinia Pammellii (Trel.) Arth. with *Uromyces graminicola* Burr., both on *Panicum virgatum*, the *Puccinia* having aecia on *Euphorbia corollata*; *Puccinia Eleocharidis* Arth. with *Uromyces Eleocharidis* Arth., both on *Eleocharis* spp., the *Puccinia* having aecia on *Eupatorium perfoliatum*; and *Puccinia angustatoides* Stone with *Uromyces Rhynchosporae* Ell. both on *Rhynchospora* spp., are other examples of heteroecious forms having for their telial hosts identical or closely related species.

The following autoecious species present the same striking correlation in all their spore forms: *Puccinia heterantha* Ell. & Ed. with *Uromyces plumbarius* Peck, both on several representatives of the Onagraceae; *Puccinia Gentianae* (Str.) Link with *Uromyces speciosus K* Holw. on *Gentiana* spp.; *Puccinia Ruelliae-Bourgaei* Diet & Holw. with. *Uromyces Ruelliae* Holw. on *Ruellia* spp.; *Puccinia opaca* Diet. & Holw. with *Uromyces cucullatus* Sydow both on *Zexmenia* spp.

There are a few slight comparative differences worthy of note in a careful study of these correlated species. The urediniospores of the *Puccinia* sp. are usually slightly larger and have thicker walls than those of the correlated *Uromyces* forms. There is also sometimes noticed a marked difference in the vigor of the two forms, the *Puccinia* being the more vigorous in its attack upon the host plant. These differences, however, only mean that the genus *Puccinia* has a greater adaptability to the environmental conditions and seems better fitted to survive than the less vigorous form. This is also brought out in the preponderance in numbers of species in the genus *Puccinia* as compared to the number in the genus *Uromyces*.

Correlation occurs frequently; however it should not be inferred that every species of *Puccinia* has a correlated form in *Uromyces*.

1679 – Wheat Attacked by Bunt. Influence of Date of Sowing.

MUNERATI, O. ; HITIER, H. Sur l'attaque du blé par la carie. Influence de l'époque de la semaille. — *Journal d'Agriculture pratique*, Year 76, Vol. II, No. 42, pp. 494-496. Paris, October 17, 1912.

Exchange of views on this subject between Dr. Munerati and M. Hitier.

In the *Journal d'Agriculture pratique* No. 37, 1912, M. Hitier wrote on the subject of the smut of wheat: "During the past season, many agriculturists in different districts of France have observed a certain number of ears of wheat infected with bunt; they were the more surprised, seeing that in preceding years there had been no trace of this fungus. It is true that in many cases the seeds had not been treated with sulphate,,

Dr. O. Munerati, the Director of the Travelling Lectureship of Agriculture of Rovigo, Italy, makes the following remarks on this subject: "The occurrence may be explained by other circumstances. It seems difficult to believe that agriculturists whose practice it is to treat their seeds with sulphate, should some years neglect this precaution."

From recent researches by Dr. Munerati, the chief factor influencing the attack of bunt upon wheat is to be sought in the weather at and after the date of sowing. As he remarks, in a communication addressed to the "Accademia dei Lincei" of Rome (June 3rd, 1911), he was induced to undertake his investigations by the strange statements which had been shown by practical experience to be correct.

A large field of winter wheat which had been sown about the end of October, in land subject to infiltration from a neighbouring stream, was much attacked by bunt (60 per cent. of the ears being infected), while the adjacent fields belonging to the same farmer, under the same variety of wheat, and treated in a similar manner (with liquid manure), but which had been sown early in October, showed no sign of infection.

Another farmer had sown spring wheat (without previously treating it with sulphate of copper) in one field at the beginning of February and in another in the middle of March. At harvest time, 30 per cent. of the ears in the first field were bunted and less than 5 per cent. in the other. Spring wheat, which it is customary to sow very early (in February, or even at the end of January) is for this reason considered by farmers to be more liable than autumn wheat to the attacks of bunt.

Another farmer, who for several years has not treated his seed in any way, has never found even one bunted grain in his fields, but he sows very early (end of September, or beginning of October).

Dr. Munerati, therefore, wished to carry out a series of experiments on infecting seed wheat with the spores of *Tilletia* and sowing the same wheat at different dates and in soils of various kinds. Quite near to the

untreated infected wheat, was sown wheat treated with sulphate of copper, as control. The following are some of the results of these experiments :

Ears infected at the time of harvest.

Date of Sowing	In Soil not subject to infiltration: Infected, untreated Wheat	In Soil not subject to infiltration: Infected Wheat treated with sulphate of copper
	%	%
Sept. 29	0	0
Oct 15	2	0
Oct. 25	4	2
Nov. 8	8	2

Date of Sowing	In Soil subject to infiltration: Infected, untreated Wheat	In Soil subject to infiltration: Infected Wheat treated with sulphate of copper
	%	%
Oct. 11	1	0
Oct. 21	3	0
Nov. 10	10	1
Nov. 22	90	4
Feb. 10	30	2
March 10	5	0

A grain which is covered with *Tilletia* spores and has not been dipped in solution escapes the attack of the parasite if sown early, but the same grain will, on the contrary, be infected by the disease, if sown when the temperature is low and the plant is making little growth. The contrary is the case with spring wheat. In practice, the later in the autumn and the earlier in the spring wheats are sown, the more necessary is it to treat the wheat with sulphate of copper, or to soak it in a solution.

M. Hitier, for his part, confirms the statement (citing the observations of M. Schribaux) that the temperature at the moment of the germination of the wheat has much to do with the attack of *Tilletia*. But the part it plays can be differently accounted for in different places. As wheat begins to germinate at 1 to 2°C., while bunt and smut require a temperature of 5 to 11°C., it is possible that the temperature may be high enough for the germination of the wheat, but not for that of the bunt-spores. This is usually what happens in the case of wheat planted late in the season in the Paris district. But November and December 1911 were, in France, exceptionally mild damp months. This accounts for the damage done by smut in 1911-1912 in fields of late-sown wheat, on farms where the use of copper sulphate is now neglected. On the other hand, the more rapid the growth of the wheat, the less are the chances of fungus attack,

for the critical time is the moment the wheat begins to shoot. It is well therefore to use large grain, which always germinates the most rapidly. In conclusion, M. Hitier recommends the treatment of wheat with sulphate, in order to guard against possible attacks of bunt.

1680 – **Investigations on the Potato Fungus *(Phytophthora infestans).***

JONES, L. R., GIDDINGS, N. J. and LUTMAN, B. F.: *U. S. Department of Agriculture, Bureau of Plant Industry, Bulletin* No. 245, 100 pp., 10 figs., 16 plates. Washington, 1912.

The potato disease termed the late-blight and rot has been known as the most serious of all potato diseases in Europe and America since about 1845, when its outbreak was the immediate cause of the Irish famine. In the State of New York alone a loss of 20 000 000 bushels in one year was attributed to this disease, and the percentage of loss may be even greater elsewhere. The disease does not attack the leaves, as a rule, until after the blossoming period, i. e., in late summer; if present and weather conditions favor, it quickly causes late-blight, which kills the foliage and thence passes to the tubers, causing the dry-rot. The disease is common in the Northeastern States, being favored by rather cool, moist summers. Farther south and west it is less common, probably only occuring locally when introduced with seed from the North. It does not long persist where the late summers are warm and dry.

It is liable to confusion with such leaf diseases as the early-blight (*Alternaria Solani*) and leaf-blotch (*Cercospora concors*) and with various types of tuber rot. It is caused by the fungus *Phytophthora infestans*. The fungus develops first on the foliage, from which it passes by means of spores that are washed into the soil to the tubers, in which it hibernates.

Jensen showed the possible efficacy of two remedial measures: *a*) Burying the tubers to a sufficient depth (about 4 to 5 inches) with soil to prevent the infection: *b*) disinfecting tubers designed for seed purposes by exposure to dry heat, 40° C. (104° F.) for four hours. Neither of these methods has become established in practice.

Studies of infection, dissemination, and disease control have shown: *a*) Tuber infection in the field may be prevented by spraying the soil even when the fungus is allowed to develop unchecked on the foliage. This is explainable only on the assumption that the primary tuber infection comes from spores washed through the soil. *b*) Tubers may also be infected from contact with blighting foliage at digging time. *c*) Secondary infection of tubers may occur either in the soil before digging or in the storage bin from spores developed on the surface of earlier infected tubers. *d*) When the tops are attacked by late-blight the harvesting of the tubers should be delayed until a week or more after the death of the tops. Longer delay does no harm unless the season be wet and the soil exceptionally heavy. *e*) Dry, cool storage is of primary importance, the use of

lime or formalin disinfection for the tubers being valueless. *f*) Wind and water are probably the important agencies in local spore distribution, but leaf-eating insects also function and may carry the spores longer distances. *g*) Spraying the foliage with Bordeaux mixture has proved an almost coomplete remedy against both the *Phytophthora*-blight and the rot, and also operates beneficially to thc potato plant in other ways. Spraying expeririments with this mixture have been made annually at the Vermont Experiment Station for 20 years, 1891 to 1910, on late or main-crop potatoes, three applications generally being made. The results were an increased yield in every case, ranging from 18 to 215 per cent. The average of the yields of the 20 years on the sprayed areas was 268 bushels per acre as compared with 163 bushels on the unsprayed, a gain of 105 bushels per acre, or 64 per cent.

Phytopthora infestans has been carried in pure culture since 1904, and some strains have been thus grown continuosly for over five years without evidence of change in pathogenicity or other characters. It grows best on blocks cut from the interior of raw potato, very well on Lima-bean agar and potato gelatin, and also, as recently shown by Clinton, on oat agar. It has been grown, but with less vigor, on various other vegetables and synthetic media. The fungus in culture will survive a fairly wide range in the reaction of the medium. Fructification was checked by an alkalinity of — 3 (Fuller's scale) and by an acidity of + 15. Vegetative growth occurred betwen — 8 and + 25. These facts are of possible interest in connection with the relation of the fungus both to the host tissues and to fungicides.

Exposing test-tube cultures for 10 minutes at temperatures up to 40° C. did not prevent later development of the fungus; beyond this temperature inhibition resulted. Where cultures were held at constant temperatures, the best growths resulted between 16° and 19° C. Below 16° C. the growth was slower, and below 5° C. it was wholly inhibited. At and above 23° C. the growth was inhibited, with no sporulation above 25° and no vegetative growth at or above 20°.

Bodies having the characters of thick-walled spiny resting spores were produced in pure cultures in potato gelatin and in Lima-bean agar. In the early stages of their development these bodies had the general appearance and the cytological characters of oogonia, but no antheridia were found, and they apparently developed asexually. Nine strains of the fungus from widely different sources in America and Europe have been studied with reference to the production of these bodies. They were found in all. Growth in mixed culture did not increase or modify them. Persistent search failed to reveal the mature stages of these bodies in cultures upon blocks cut from potato tubers, although what were considered to be immature stages of the same bodies were found sparingly. No such

bodies have been found in decaying potato tubers following *Phyphthora* attacks. Examinaton of potato leaves killed by *Phytophthora* showed that somewhat similar bodies occur. Some of them clearly originated from secondary saprophytes, and probably all so originated. No opinion is therefore justified as to the occurrence of such resting spores in nature, although their appearance in the culture tubes proves that *Phytophthora* is capable of developing such bodies. In no case have these spores been seen to germinate.

Inoculation of potato leaves different varieties with *Phytophthora* cultures showed that certain varieties are much more susceptible than others. This difference was shown in the rate of progress through the leaves following infection as well as in the number of leaves infected. This fact indicates that the disease resistant quality is largely, if not wholly, resident within the mesophyll and that it is independent of epidermal characters. Inoculations of sterile blocks cut from the flesh of potato tubers with *Phyphthora* cultures showed a wide range in vigor of growth, i. e., in *Phytopthora*-resisting properties. Blocks cut from different parts of the same tuber, and also from different tubers of the same variety, gave essentially like results. There was much difference, however, as between varieties. This difference was sufficiently marked to permit of their being graded on a percentage basis with a fair degree of assurance and to enable one to distinguish with full confidence between the especially disease-resistant varieties and those that were more susceptible.

A comparison of the conclusions reached by this laboratory method, using pure cultures for determining the relative disease-resistant quality of potato tubers, with the amount of tuber rot recorded by Stuart from field trials of the same varieties, gives ground for confidence in its reliability as a method of judging of the rot-resistant qualities of the variety under trial. It is a method having at least much value as supplementing field trials for the determination of disease resistance, if not of replacing them entirely. These studies confirmed the conclusions reached by Stuart from his field trials that certain standard European varieties are much more highly resistant to *Phytopthora* attacks than are the standard American varieties.

Efforts to determine more definitely the location or nature of the disease-resisting property gave little that was definite beyond the fact that it was resident within the flesh of the living potato tuber and uniformly distributed through it. The difference was not correlated with differences in the relative acidity of the sap or in any other chemical factor determined, and it was apparently lost with the extraction of the juice and with cooking.

1681 - **Cotton Anthracnose.**

BARRE, H. W.: *South Carolina Agricultural Experiment Station of Clemson Agricultural College, Bulletin* No. 164, 22 pp., 7 plates. Anderson, S. C., 1912.

Cotton anthracnose is a widespread and destructive disease in South Carolina. The disease is caused by a fungus (*Glomerella Gossypii*) which grows as a parasite in the parts of the plant and destroys the tissues. The fungus which causes the disease grows into the seeds before they are mature and remains alive there until the seeds are planted. When such diseased seeds are planted in less than three years from the time of maturity they produce diseased plants. Diseased seed is the most important factor in the spread of the disease. By careful selection, seeds which are free from anthracnose can be secured from a field where the disease is present. The fungus which causes anthracnose does not remain alive in the field for more than one year. Crop rotation and seed selection will control cotton anthracnose.

1682 - **Diseases of Tobacco in Sumatra.** — See above, No. 1631.

1683 - ***Fusarium Dianthi*, a Fungus attacking Cultivated Mint.**

FOEX, E. and BERTHAULT, PIERRE. Une maladie des Menthes cultivées. — *Journal d'Agriculture pratique*, Year 76, Vol. II, No. 41, pp. 461-462. Paris, October 10, 1912.

A disease of cultivated mint has been observed in the Department of Alpes-Maritimes, and has been studied by the writers at the Paris Station of Phytopathology. The infected plants show signs of withering, and the crown and the base of the stem are of a blackish or brown colour. Sections show the presence in these regions of a white cylindrical mycelium, which occupies the cellular cavities as well as the intercellular spaces and also invades the cortex and the wood.

The writer gives a somewh at detailed description and 6 figures of the parasite, which is identical with *Fusarium Dianthi* of Prillieux and Delacroix and with *F. roseum* of Mangin. According to Delacroix, *F. Dianthi* is the conidial form of *Neocosmospora vasinfecta*. But neither on the pink nor on the mint have perithecia been found, to prove that the fungus belongs to this species.

Neocosmospora vasinfecta attacks a large number of plants: peas, cotton, lupins, beans, medicinal herbs, etc.; but it seems hitherto not to have been found on mint.

The writers advise the following methods of control: 1) Up-rooting and burning diseased plants of mint on the appearance of the first symptoms, leaving the cleared area uncultivated for at least three years, and removing all weeds which may spring up.

2) The introduction into the soil, by means of an injector, of at least 50 gr. (nearly 2 oz.) of commercial formic aldehyde for each square metre (just over 1 sq. yd.) of the infected soil. The cost of this latter treatment is 10 to 11 centimes (1 *d.*) per sq. metre, not counting the labour.

1684 – *Cladosporium fulvum* var. *violaceum*, a Tomato Parasite on the Ligurian Riviera.

VOGLINO Prof. PIETRO. Sopra una nuova infezione dei pomidoro. — Extract from *Annali della R. Accademia di Agricoltura di Torino*, Vol. IV, 5 pp. Torino, 1912.

The writer found that in April 1912, on the Ligurian Riviera, the young tomato plants in the greenhouses were much infected. Numerous round yellowish patches, 6 to 10 mm. in size, appeared on the lower surfaces of the leaves, together with a dusty, downy, reddish violet deposit. The patches increased rapidly in number, and spread from one plant to another. The discoloration in the end extended to the whole lamina and the infected parts soon withered. In sections of infected portions the mycelium of a fungus was found, which in its characteristics corresponded on the whole to *Cladosporium fulvum* Cook, a species already observed in North America, Italy, France, Holland and Belgium. The form discovered by the writer at Albenga is distinguished by the possession of external hyphae and conidiophores, which are always of a dark reddish violet; hence its name *C. fulvum* var. *violaceum*.

1685 – A Knot of Citrus Trees caused by *Sphaeropsis tumefaciens*.

HEDGES, FLORENCE and TENNY, L. S.: *U. S. Department of Agriculture, Bureau of Plant Industry, Bulletin* No. 247, 74 pp., 8 figs., 10 plates. Washington, 1912.

From knots on lime and orange trees received from Jamaica, a fungus, *Sphaeropsis tumefaciens* Hedges, has been isolated which reproduces the knots when sound trees are inoculated with pure cultures of it. Small knots have also been obtained on pomelo, lemon, *Citrus trifoliata*, and tangerine. From these artificially produced knots the fungus has been again isolated and with it successful inoculations on sound trees have been made. The fungus penetrates the tissues far beyond the original point of infection and a badly infected tree is a mass of tumors, sometimes so close together that one cannot put a finger between them. On the other hand, there may be considerable distances between two secondary tumors with no external evidence of the fungus, but microscopical examination reveals its presence in small quantities throughout the intervening portion of the stem. This important fact should be borne in mind in pruning for the purpose of eradicating the disease. An abnormal number of new shoots often grow from the knots, forming a witch's broom. This is characteristic of the disease under favorable conditions. Ultimately that portion of the branch above the knot dies.

The mycelium may occur in any or all of the tissues of the stem, producing black areas if present in abundance. Pycnidia may or may not be produced. The Jamaican lime strain has, up to this time, fruited rarely, pycnidia having been observed only in a few very old cultures, and a small number of artificial infections on the hosts (lime, pomelo, and *Citrus trifoliata*). A vigorously fruiting orange strain has arisen, however, from cultures grown from germinating spores in plates poured from pycnidia in a 6 months-old corn-meal culture. Another orange strain isolated later from the same lot of knots has never, to the writers' knowledge, produced pycnidia in culture media, although it has produced them on lime shoots. A second vigorously fruiting orange strain has been isolated from one of the knots produced by the inoculations of July 20, 1910. Spermogonia occur both on the host and in cultures. Chlamydospores are often present in abundance in old cultures, but have never been observed on the host. No perithecia or conidia have ever been observed. A stroma is produced on many media but not upon the host. The fungus is easily isolated by ordinary mycological methods and grows well on a large variety of media. It liquefies gelatin, partially or entirely digests casein and has a strong diastasic action. Optimun temperature about 30°C. The fungus can live for some years in the host. It has been isolated from secondary knots four years and eight months after the tree was inoculated and one year after it has been cut down and brought into the laboratory.

Affected limbs should be removed, care being taken to cut them off well below the lowest knot. Badly diseased trees should be rooted out and burned, that they may not prove a source of infection to sound trees through the dissemination of the fungus spores. Great care should be taken to select only sound trees for grafting purposes. The recent discovery of this or a similar disease in Florida should put growers in the United States on their guard against the spread in this country of a new menace to citrus fruits.

1686 – Recent Studies on Diseases of Cocoanut, Cacao and Fruit Trees in Trinidad.

1. Rorer J. B. Bud-Rot of the Coconut Palm.
2. Id. Some Fruit Diseases.
3. Id. Cacao Spraying.

Department of Agriculture, Trinidad and Tobago. Bulletin, Vol. XVI, No. 70, pp. 68-69 75-76; 34-36. Trinidad, 1912.

1. *Bud-rot of the Coconut Palm* (1). — Bud-rot is the most serious disease of the coconut palm. Perhaps the most damage has been done in Cuba

(1) See No. 250, *B.* Jan. 1912; No. 598, March 1912. (*Ed.*).

where the disease has practically wiped out many of the best coconut estates, but great loss has also been sustained in the West Indies and in Central American countries. Within the past few years the disease has been carefully studied and the conclusions reached show that bacteria are the real cause of the trouble and that insects are instrumental only as carriers of infection. Mr. J. R. Johnston (*U. S. Deptm. of Agriculture, Bureau of Plant Industry*, Bulletin No. 228. Washington, 1912) has proved by inoculation experiments that the disease is due to a specific bacterium which is so like *Bacillus coli* that the two cannot be distinguished, and that the disease can be produced by inoculation with pure cultures of *B. coli*.

The disease gains entrance to the tree as a rule at the bases of the leaves or flower stalks. When the point of first attack is in the outer leaves or older flower stalks, the bud and young leaves may remain unaffected for a long time ; but if the infection takes place in one of the central leaves the bud soon rots and falls over. Whether the bacteria can gain entrance to the tissues through the unbroken epidermis, or whether a wound is necessary, the writer has not been able to make out; however, it is possible to infect trees, without wounding them artificially, simply by pouring a pure culture of the causative organism into the crown.

Bud-rot has been quite prevalent in Trinidad, but measures are being taken to prevent its spread. So far sanitation alone has been used, but the good results have been very marked in that the disease has been greatly reduced. From November 30 1909 until February 1911, about 18 000 diseased trees were destroyed. The new Plant Protection Ordinance, 1912, will make compulsory for all property owners having diseased coconut trees to destroy them at once. Some success has been attained in Trinidad in keeping down bud-rot by the use of disinfectants placed by hand in the crown of the trees. Salt, iron sulphate and copper sulphate have successfully been used for this purpose.

2. *Some Fruit Diseases.* — During the past season (1911-1912) many mangoes and avocadoes which had been shipped from the West Indies to the United States and England have rotted in transit and, at times, whole shipments have been lost. Regardless of variety and of care in picking and packing, a great part of the deterioration of these fruits is due to the growth of parasitic fungi. The chief offender in the case of the mango is *Gloeosporium Mangiferae* (2), while with the avocado it is a species of *Colletotrichum*. The disease caused by these fungi is commonly known as anthracnose or black spot. In each case the fungus attacks not only the fruits in all stages of development but

(2) See No 251, *B.* Jan. 1912. (*Ed.*).

the leaves as well, and in the case of the mango the flower and flower stalks. The anthracnose on both the mango and the avocado pear can be readily controlled by spraying with Bordeaux mixture.

Bananas in Trinidad are so susceptible to diseases, which as yet can not be adequately controlled, that they are not planted to any extent save as catch crops and shade plants for young cacao trees. The two most prevalent troubles are the Panama (1) and moko diseases. The exact cause of the Panama disease has not as yet been proved, but the evidence points to a fungus belonging to the genus *Fusarium*. The Gros Michel variety is especially susceptible to this disease, whereas the Cavendish or Canary (*Musa chinensis* Sweet; *syn M. Cavendishii*) and Congo banana are immune. The moko disease is of bacterial origin and seems to show a preference for the varieties resistant to the Panama disease. The plantains (*M. sapientum* var. *paradisiaca*) the Cavendish and red banana (*M. rubra*) are very susceptible, the Gros Michel is very resistant.

3. *Spraying Cacao.* — Up to the present time few experiments have been made to determine the real value of spraying in combating fungous and insect pests under tropical conditions. In order to ascertain if the same means of control used in the North could be applied in the Tropics, especially with reference to the diseases and pests of cacao, a series of spraying experiments was started in Trinidad two years ago. The diseases so far controlled in these experiments were the canker and the black pod-rot of the cacao plant, both of which are caused by *Phytophthora Faberi*. The following plan was adopted. A block of 1000 trees was selected and divided into two equal parts, one of which was sprayed while the other was left unsprayed as a control. A preliminary work showed that it was perhaps best to spray the trees when they were well covered with young fruits. This was then done and a second application was made from 4 to 7 weeks after the first. Bordeaux mixture made on the 4-4-50 and 5-5-50 formulae was used. All of the results were very satisfactory: the amount of black cacao at picking time was reduced in some cases from 40 per cent. to 10 per cent; furthermore, the yield in total number of pods was greatly increased by the spraying. In one experiment 7010 pods were gathered from the 500 sprayed trees, against 4 805 pods from the adjacent 500 unsprayed tress. Allowing the maximum cost for labour, materials, etc., to be one cent per tree per application, there was a net gain of over $ 20 from the 500 sprayed trees.

(1) See No. 980, B. June 1912. (*Ed.*).

1687 – **The Large Leaf Spot of Chestnut and Oak (*Monochoetia Desmazierii* Sacc.).**

GRAVES, ARTHUR D. in *Mycologia*, Vol. IV, No. 4, pp. 170-174 + plate LXIX. Lancaster, Pa., 1912.

The writer has named this disease the « large leaf spot » in contradistinction to the small leaf spot, which is common on chestnut leaves and caused by *Septoria ochroleuca* B. &. C..

In the summer of 1910 the writer found the large leaf spot occurring abundantly on leaves of *Castanea dentata* in Bedford County, Virginia; in Transylvania, Jackson and Macon Counties, North Carolina, and in Rabun County, Georgia. It was found commonly also on leaves of *Quercus rubra* L. in Transylvania County, North Carolina. A similar disease has been briefly mentioned by Stevens and Hall (*Diseases of Economic Plants*, 1910) under the title of Monochetiose. This disease, which they refer to *Monochoetia pachyspora* Bubák, may be the same as that observed by the writer, and if it is so, it is probably more correct to refer it to *Monochoetia Desmazierii* Sacc. This point, however, will require further investigation.

The large leaf spot begins to make its appearance on leaves as circular spots, from 1 - 2 cm. in diameter, usually pale with a darker line around the margin. As the disease advances, concentric zones are added of the same nature. Thus, large spots are formed stretching across the entire width of the leaf. Several large spots may join and over half of the leaf may be killed. In some cases, individual trees were observed which had suffered a loss of perhaps 40 per cent. of the green assimilating tissues of their leaves.

Successful infection experiments have been carried on by the writer with *M. Desmazierii*. Descriptions of the fungus are given.

It is believed that the attacks of this fungus cause a considerable diminution in the annual wood increment. As it appears that this trouble is disseminated over the whole southern Appalachian region, it is one of considerable importance. As far as the disease occurs in the forest, very little can be done at present to check it. In case of individual trees the ordinary methods of spraying will probably prevent its recurrence. The diseased leaves should be raked up in the fall and burned, as they harbor the fungus spores over winter.

PARASITIC AND OTHER INJURIOUS FLOWERING PLANTS,

PARASITIC AND OTHER INJURIOUS FLOWERING PLANTS

1688 - ***Panicum phylloryzoide*: a Rice-Field Weed in Italy.**

NOVELLI, N. Una nuova varietà di giavone che si diffonde! — *Il Giornale di Risicoltura*, Year II, No. 19, pp. 305-307. Vercelli, October 15, 1912.

Since the appearance of *Panicum phyllopogon*, followed by *P. erectum*, plants which cause great injury to the Italian rice-fields owing to their ever-increasing diffusion, a new weed must be mentioned, which was found by the writer some years ago in several rice-fields in the Lomellina, where he had sown as an experiment several recently imported varieties of rice, such as Sekijama, Omaci, and Fuku-Shima. The writer thought at the time, that the weed having appeared very late, would not come to maturity ; but this year, he found it had spread to many fields of native rice in the Lomellina and the districts of Vercelli and Novara, where, in spite of the cold season, it was expected to ripen, although it was backward.

It can be affirmed with certainty, that the seeds of this weed have come with recently imported varieties of rice. It much resembles rice, which makes its extirpation a matter of some difficulty ; this similarity led M. Novelli to suggest that the weed should be called *Panicum phylloryzoide*. The best method for its control is careful preparation of the rice seed and the destruction of the pest before the harvest. Further, it is well to clean very carefully all freshly introduced varieties of rice, in order to avoid importing new harmful plants at the same time; the hope is expressed that the Italian Government will exercise control over the purity of imported seed rice

INSECT

GENERALITIES

1689 - **Note on the Life-history of Several Species of Aphides.**

MOORE, W. in *The Agricultural Journal of the Union of South Africa*, Vol, IV, pp. 425-428. Pretoria, September 1912.

The black peach aphis (*Aphis persicae-niger*) breeds constantly all through the winter on the underside of the small limbs and shoots. Of those observed by the writer during the past winter, large numbers were destroyed by a braconid. As the black aphides immediately work their way into the peach blossoms when the tree blooms, the time to spray is in the early spring (September). Whale oil soap and tobacco extract, or lime and sulphur wash are advised.

Wherever the citrus trees are able to withstand the frost the black citrus aphis. (*Siphonophora citrifolia*) seems to be able to breed through the winter. The breeding, however, is not rapid. Where the citrus trees are frosted the aphis is killed by the frost. Sprays just before the warm spring are advised.

The woolly apple aphis (*Schizoneura lanigera*) in South Africa has quite a different method of passing the winter from that of the woolly aphis of colder countries. In cold contries, with the approach of winter, winged forms are produced which produce male and female insects. After mating, the female produces one large egg, which carries the species through the winter. In South Africa no winged forms are produced in the autumn, but when the weather becomes quite cold, young are born, which hibernate without feeding. As such young are easier to kill than eggs, spraying with lime sulphur early or late in the winter sould be very beneficial.

1690 – **Green Peach Aphis *(Myzus persicae)* and its Control.**

MOORE, W. in *The Agricultural Journal of the Union of South Africa*, Vol. IV, No. 3, pp. 419-425. Pretoria, September 1912.

The paper under review gives the life history of the green peach aphis (*Myzus persicae*), commonly called the green fly of peach, as far as it has been worked out in South Africa.

In the spring, females attack the leaves of the peach trees, which curl up, turn yellow and often drop off from the tree. These females produce without fertlization living young, which rapidly mature, and also produce young without fertilization. As the leaves of the tree become overcrowded, young are produced which mature into winged females. These — the spring migrants — spread to neighbouring trees and produce young in the same way as did the wingless females. When the weather becomes quite warm, and generally about the time of the first rain, the aphides of both the winged and the wingless form migrate to the vegetable garden, where they attack various garden vegetables. Turnips, radishes, cabbage and cauliflower seem to be their favorite food. All through the summer the aphides reproduce without fertilization. When the plants become overcrowded, winged forms are produced which distribute the pest to other clean garden plants.

In temperate countries, at the approach of winter, winged forms — the fall migrants — are produced, which fly back to the peach trees. They there produce females which, when full-grown, are reddish in colour. By the time they are full grown, winged males are being produced in the vegetable garden, which make their way to the peach trees, where they fertilize the reddish females. The female then lays in the axil of a bud an

egg which serves to carry the insect safely through the cold weather, when all the aphides are killed by the cold.

In South Africa, however, the climate does not seem to be cold enough to necessitate the aphides laying eggs. A few winged forms are produced in June, which return to the peach tree, where they produce young which on maturing are of a reddish colour. The writer has not been able to find males. Most of the aphides, even of the winged form, continue breeding on the underside of the leaves of cabbage and cauliflower through the winter.

The writer has observed that on the26th August - when some of the peach trees were in bloom - the plant lice were still on the cabbage plants. Hence it would seem that they will not return to the peach trees until the young leaves are produced. Spraying of the leaves should then be done at the earliest possible moment, before the lice cause the leaves to curl.

One of the best sprays is a mixture of whale oil soap and tobacco extract. A formula for home-made whale oil soap is here given: — 6 lbs. caustic soda, 1 $^1/_5$ gal. water, 22 lbs. fish oil; or 1 lb. caustic soda, $^1/_5$ gal. water. 3 $^2/_3$ lbs. fish oil. The caustic is dissolved in the water; the fish oil is slowly added to the still hot solution while the mixture is being constantly stirred; 1 lb. of the soap which forms upon cooling is dissolved in 10 gals. of water, and half or one pint of good tobacco extract is added.

Parasites of Green Peach Aphis. — The braconid (*Aphidius* sp.) deposits an egg within the body of the aphis. Some species of braconids, however, cannot breed at so low a temperature as the aphides are able to breed; thus in the winter and spring the aphides become more abundant. Both the larva and the adult of the red-spotted ladybird (*Chilomenes lunatus*) feed upon the green peach aphis. The maggot of the syrphid fly inserts its mouth into an aphis and extracts the body juices and finally destroys the aphis. The syrphid fly, however, is itself the host animal for a small wasp parasite (*Bassus* sp.), which lays its eggs in the maggot of the syrphid fly.

1691 - Life-History Studies on the Codling Moth in Michigan.

HAMMAR A. G.: *U. S. Department of Agriculture, Bureau of Entomology, Bulletin* No. 115, Part I, 86 pp., 22 figs., 3 plates. Washington, 1912.

The present account of the life history of the codling moth (*Carpocapsa pomonella*) in Michigan is based upon a series of studies made in 1909, 1910 and 1911.

In the course of a year the codling moth in Michigan produces one full brood and a partial second. In the field the earliest moths of the spring brood commence to appear from 5 to 10 days after the apple blossoms

drop, and the earliest larvae of the first brood hatch from 3 to 4 weeks after the petals drop. The earliest larvae of the second brood hatch from 10 to 11 weeks after the petals drop. During exceptionally warm and forward seasons the second-brood larvae may appear considerably earlier, and were, in 1911, observed 8 weeks after the petals dropped. This record, however, should be considered very exceptional.

Egg deposition commenced in the cages from 3 to 9 days after the emergence of the moths, and most of the eggs were laid within 5 days after egg deposition commenced. In one instance eggs were laid 23 days after the emergence of the moth, but as a rule the great majority of the eggs were laid within 8 days of the emergence. The number of eggs per female varied considerably in the cages: on an average, 57 eggs per female were obtained. A single female deposited 161 eggs. Under normal conditions in the field the average number of eggs is unquestionably higher and probably approaches 80 to 90 eggs per female.

The average length of life of the moths was found to be 9 days for the males and 11 days for the females. Instances occurred when one male lived 32 days and a female lived 37 days.

The length of the incubation period of the eggs varied greatly under different temperature conditions. For the first brood the average length was 7 days and for the second brood 8 days. The range of variation extended from 4 to 16 days.

The length of the feeding period of the larvae of the first brood varied from 17 to 45 days and averaged 25 days for the "transforming" larvae and 28 days for the "wintering" larvae. Still larger variation in the length of feeding was observed in the second brood, ranging from 20 to 84 days and averaging 36 days. On an average the larvae spun their cocoons and pupated in 7 days. This period varied, however, from 3 to 18 days.

The pupal stage varied greatly under different temperature conditions. The average length of the pupal stage was 18 days, but it ranged from 1 week to 2 months.

The length of the first generation, from the time of the appearance of the eggs to the time of emergence of the moths that resulted irom the same, averaged 51 days in 1910. During 1911 the duration of the life cycle varied from 29 to 87 days and averaged 50 days.

The relative abundance of first-brood and second-brood larvae varied from year to year. In 1909 second-brood larvae surpassed the first brood in numbers and constituted 57 per cent. of the larvae for the season. During 1910, owing to the wide-felt scarcity of apples, the second brood only reached one-third the number of the first brood. During 1911 the second brood almost approached the first in abundance.

Of the first-brood larvae only a portion transformed the same season, while the other portion passed the winter in the larval stage. During

the three years of observation, the ratio between transforming and wintering larvae of the first brood varied from 30 : 70 per cent. to 51 : 49 per cent. respectively and averaged 36 per cent. transforming larvae and 64 per cent. wintering larvae. The larvae of either brood shed the skin (molted) five times, and had thus six "instars". A limited number of larvae molted only four times.

A hymenopterous fly, *Ascogaster carpocapsae* Vier., was found to parasitize from 6 to 7 per cent. of the larvae of the codling moth. Hibernating codling-moth larvae succumb extensively to the cold during the winter. From 25 to 35 per cent. were found to be killed.

From the foregoing records of the life history of the codling moth and from the variability of results obtained, it is evident that reliable data can only be obtained from a large number of observations.

From the point of view of mechanical control of the codling moth, the most important observations of the habits of the insect relate to the time of emergence of the moths in the separate broods. Such observations should preferably be made from carefully conducted band records. It is essential that the collecting of larvae from the banded trees should commence sufficiently early in the season, so that the earliest appearing larva may be secured. It is also of importance to make the collections at regular and frequent intervals (three days), and for the entire season. Apple trees of late varieties should be selected whenever available.

On applying the results of this investigation to the present methods of controlling the codling moth in Michigan, it will be found that the poison-spray applications should be most effective when applied at the following periods:

1) Shortly after the petals drop, to fill the open calyx cup and thus destroy the larvae which hatch later. It is the habit of most of the first-brood larvae to penetrate the apple through the calyx end.

2) From three to four weeks after the petals have dropped, when the first-brood larvae commence to hatch.

3) Ten weeks after the petals have dropped, when under normal seasons the first larvae of the second brood commence to appear. During advanced seasons the above period may be shortened to nine weeks and only very exceptionally to eight weeks, as noted in 1911.

1692 – **Immunity of Lemons from Fruit-Fly *(Ceratitis capitata)* in Sicily** (1).

MARTELLI, GIOVANNI. La mosca delle arance non vive nei nostri limoni. Extract from *Giornale di Agricoltura Meridionale*, Year V, No. 9, 8 pp. Messina, 1912.

Careful investigations have established, unless subsequent facts prove

(1) See also No. 3253, *B.* Nov.-Dec. 1911. (*Ed.*).

the contrary, that the Mediterranean Fruit-Fly (known locally as "verme") is not found on the lemons grown in the island of Sicily.

Another positive fact tending to prove the truth of this assertion, is that, though the citrus trade of Italy with the United States (the Official documents collected by the writer go as far back as 1862) has continued for perhaps over half a century without interruption, a more than sufficient period of time for the appearance, at all events to a limited extent, of this insect, no colonist, entomologist, or fruit grower has complained of the presence of *Ceratitis*.

Further, another factor which prevents the introduction of this pest into the United States is the method of selecting the fruit which obtains in Sicily. Before being shipped, or put into trains for conveyance abroad, the lemons are carefully picked over three, or even four, times. If they were infected, the lemons after 3 or 4 days, and still more after the lapse of some months, would show the characteristic symptoms of the disease, which are well-known even to the peasants; thus when subjected to scrutiny, the diseased fruits would at once be removed. Oranges and tangerines, which are really infested by *Ceratitis*, undergo the same treatments as the lemons, and so far the introduction of the pest into America has not been observed, even in their case.

1693 - The Phylloxera Invasion and the Reconstitution of Vineyards in Spain.

JANINI JANINI, R. Breve reseña de la marcha de la invasión filoxérica y de la reconstitutución de los viñedos en Espana, 14 pp. Valencia, 1912.

Phylloxera made its appearance for the first time in Spain in 1876, in the vineyards of the provinces of Malaga and Gerona ; from this date it has continuously spread. In 1891, there were three invasion centres : the first included the provinces of Gerona, Barcelona and Tarragona, with 108 788 acres of infected vines and 95 121 acres destroyed by the pest; the second included the provinces of Orensa, Leon, Zamora, Salamanqua and Lugo, with 12 123 acres infected and 14 367 acres destroyed ; and the third consisted of the provinces of Malaga, Grenada, Almeria, Cordova, Seville and Jaen where 40 056 acres were infected and 333 773 acres destroyed.

The most recent data concerning the advance and extension of phylloxera were published at the end of 1911 by the " Junta Consultiva Agronomica," and apply to 1909.

The following items have been taken from it.

	acres
Total area destroyed up to 1909	2 562 010
„ „ not reconstituted	1 880 176
„ „ attacked	309 614
„ „ reconstituted	800 272
„ „ immune in the 43 infected provinces	1 635 190
„ „ of primitive vineyards	5 018 348
„ „ of vineyards in production during 1909	3 204 582
Total diminution of vineyard area	1 813 766

As the above table clearly shows, the reconstitution of vineyards in Spain does not keep pace with the spread of phylloxera. Replanting is not carried out in the proportion that destruction is wrought by the insect, and some of the reconstitution work is imperfect, or badly done; further, much of the soil is unsuitable. On the other hand, the condition of the wine market and the economic situation of many of the vine-growers prevent the latter undertaking the reconstitution of the vineyards destroyed by phylloxera.

The Panadés zone of the province of Barcelona is the one which has been most successful and active in vineyard reconstitution. It must, however, be acknowledged that this is one of the districts of Spain where vine growing and wine-making are the most developed. Another district which has made great efforts to extend vineyard reconstitution is Navarre. The provinces of Gerona, Malaga and Rioja have also made efforts in this direction.

Disregarding for the moment the chief details concerning the phylloxera outbreak and those of the reconstitution of the Spanish vineyards, we will first mention the attempts made in Andalusia for the destruction of this insect by D. Mariano de la Paz Graells in 1878 and by Sr. Miret in Catalonia in 1879. But their exertions were useless in face of the destruction wrought by the pest. Finally, the vine-growers, especially the Catalans, began the work of reconstitution. Experiments were made in Catalonia and Malaga with Riparia, Rupestris and other varieties, but the unsuitable soil of Malaga, together with the grafting systems employed, resulted in enormous losses from growing Riparia in Andalusia. On the other hand, at Gerona, in Ampurdan, where the soil is a quaternary alluvium derived from granite and free from lime, the cultivation of Riparia and Solonis extended much and gave good results. Riparia, however, did not succeed well in reconstituted vineyards where the soil contained more lime than at Ampurdan (*viz.* at Barcelona and Tarragona). As in Hérault, so also in Catalonia, recourse was had to Rupestris du Lot, and Don Marcos Mir y Deas introduced the first calcimeters. The success

of Rupestris du Lot in Catalonia marks an important stage in the reconstitution of Spanish vineyards. At the same time, at the instigation of Don Manuel Raventós, successful experiments were made with other stocks. From this date and long after, owing to the success of Rupestris du Lot, Catalonia became the centre of the nurseries of American vines in Spain.

In Navarre, on the contrary, G. de los Salmones carried on an active propaganda for the introduction of Mourvèdre × Rupestris 1202 in calcareous soils and of Aramon × Rupestris No. 9 in soils suffering from drought. This propaganda was supported by the chief owners of nurseries in Catalonia and Navarre and by some of those in Aragon. But the climate of Navarre, together with frequent failures, caused the abandonment of the primitive Catalan methods such as planting out slips or American shoots in the open, and their subsequent grafting. The system of grafting in the nursery was substituted.

At the same time the Spanish vine-growing crisis affected the owners of nurseries of American vines ; owing to the little reconstitution carried out, the sales were small, and the number of owners of nurseries decreased. The Catalan growers with plenty of capital alone remained to continue the propaganda of the Riparia varieties, and especially of Rupestris du Lot.

The phylloxera, which had probably already before 1910 begun its ravages in the vineyards of Valencia and Alicant, where it is now rife, has allowed the proprietors of nurseries of American vines to find a good market for their produce of late years. At Valencia, Alicant and Castellon a great propaganda was carried on of Riparia and Rupestris du Lot ; but these vines being planted in very dry calcareous soils, much loss was sustained. Nevertheless, about five years ago a well-conducted system of vineyard reconstitution was commenced. Experiments were made on a large scale with Rupestris du Lot, Riparia × Rupestris Nos. 3306 and 3309, Aramon × Rupestris No. 9, Mourvèdre × Rupestris No. 1202, Berlandieri × Riparia Nos. 420A and 420B, and Chasselas × Berlandieri 41B. Certainly in the last 5 years (to the detriment of Riparia × Rupestris and of Rupestris du Lot) Mourvèdre × Rupestris 1202, Berlandieri × Riparia 420A and Chasselas × Berlandieri 41B have acquired an increasingly well-merited reputation, although it will always be necessary to contend with the unsuitable nature of the soil.

MEANS OF PREVENTION AND CONTROL

1694 - On the Destruction of Certain Hemiptera by Vegetable Parasites.

LE MOULT, LEOPOLD. Sur la destruction de certains Hemiptères par les parasites végétaux. — *Comptes-Rendus Hebdomadaires des Séances de l'Académie des Sciences*, Vol. 155, No. 15, pp. 656-658. Paris, October 7, 1912.

The aim of this article is to show that various hemiptera can be destroyed by means of vegetable parasites. The following experiments were carried out in Nièvre (France).

Some cabbage bugs (*Pontatonia ornatum*), infected with an artificial culture of *Sporotrichum globuliferum*, were destroyed after the fifth day, and on the tenth day not one was left alive.

Apple trees invested with the white covering which indicates the presence of the woolly aphis (*Schizoneura lanigera*) were infected in September 1911 with *Sporotrichum globuliferum* and *Botrytis bassiana*; each of these parasites was used separately on two rows of cordon apples 80 yards apart. At the foot of each tree, pieces of microbic culture were dug in, and the same culture was sprayed into the air and upon the trunk and branches.

On the two estates where the experiment was carried out, the woolly aphis did not appear in the apple trees which were treated, although this insect was found elsewhere in abundance.

On June 5th 1912, the writer treated apple trees with mixed cultures of *Isaria densa*, *Sporotrichum globuliferum* and *Botrytis bassiana* and again succeeded in freeing the trees from aphides. Having collected many leaves bearing dead insects, he obtained cultures of the parasites having caused the death of the latter.

A last experiment was made in August on 92 cordon apples At the foot of each tree, two or three pieces of a culture of *Isaria densa* were dug in, then spores of *Botrytis bassiana* were sprayed on the branches and trunk of the upper portion of the alley (46 trees) and spores of *Sporotrichum* on the other 46. On September 11th, the writer noticed that in the upper part the aphides had entirely disappeared, but in the lower part, some white patches were still visible, seeming to show that *Botrytis bassiana* acts more powerfully than *Sporotrichum globuliferum*; but this was probably due to the fact that the spread of the disease was facilitated by the larger number of aphides present in the upper part.

These encouraging results have determined the writer to try the same measures as a remedy against phylloxera.

1695 - **The Bud-Worm of Corn.**

INSECTS INJURIOUS TO VARIOUS CROPS.

THOMAS, W. A. (in co-operation with the Bureau of Entomology, United States Department of Agriculture): *South Carolina Agricultural Experimental Station of Clemson Agricultural College, Bulletin* No. 116, 6 pp. 1 fig. Anderson, S. C., 1912.

During the past few years there has been a growing demand among the farmers of the State for information in regard to the Southern corn-root worm or bud worm (*Diabrotica 12-punctata*, Oliv.) which attacks the young growing corn, usually upon low, moist land. The experimental work on this pest will not be completed until the end of the next season, but these records are published with a view towards giving immediate information to those desiring it.

The full grown insect, generally known as the 12 spotted cucumber beetle, occurs on every farm in South Carolina. Although common in every vineyard, vegetable garden, and flower garden in villages, towns and cities, the greatest amount of injury is occasioned by the larva of the insect feeding upon the roots of the corn.

The principal injury to corn is caused by the small larva of the insect boring into the tender stalk of the young corn, usually just above the junction of the tap root and the stalk, or just above the first row of circular roots. Here the larva feeds, cutting off all the stalk, except one or two of the outer layers, causing the bud of the corn to die, leaving one or two green leaves at the bottom of the stalk. These leaves have a hard stunted appearance. Sometimes the larva, after killing the bud of the plant, feeds upward, and at others, it goes downward into the tap root. In either case, the small bud is killed, and growth stops. After the plants have grown to a height of 12 inches or more, and with a vigorous stalk, no damage can be done ; the larva merely gnaws the outer tissues of the plant at the usual point of attack, as described above, and which slightly checks the growth, but which rarely proves fatal. It is very seldom that a larva of this insect reaches the pith of such a plant.

The eggs are laid by the female beetle in the soil at the base of the young plant. The resulting larvae bore into the tender stalk and feed upon the tissues. When full grown, the larva leaves its food plant, forms a small earthen case in the soil near by, and there passes a quiescent stage, or pupa, from which it emerges a little later as a fully matured beetle.

In the experiments at Marion, the first eggs were laid March 10. All of these had hatched by April. These larvae had all formed earthen cells in which to pupate, or transformed to the adult beetle, by May 5. The fully developed beetles had all emerged by May 24. Thus the entire life history from egg to adult was completed in 75 days. These experiments were checked by actual field examinations and the experimental results agreed with the field observations. No second generation of the insect was bred in the laboratory last season, owing to the fact that the first generation is the important one in the corn fields.

During the winter there is no complete hibernation of the beetles in the vicinity of Marion. At the approach of severe cold waves, they find shelter beneath leaves of weeds in the fields and in other protected places, until the wave has passed, when they again begin feeding. *Gnaphalium purpureum* und *Uliginosum purpureum*, two species of life-everlasting, grow abundantly in nearly every field in South Carolina. These plants afford them a continuous food supply throughout the winter and provide them with convenient and ample protection from the cold.

Judging from the experiments at Marion and from observations in various sections of the State, we may safely place the pupation period for lower

South Carolina at May 5. In the Piedmont region, the pupation period comes about two weeks later, or about May 19. In the central portion of the States, or about the foot-hills, the pupation period may be placed at about May 12.

Owing to the well protected habits of the insect at its period of greatest injury, the extreme difficulty in securing a substance, which, if applied to the soil, would be effective in controlling the insect, is readily seen. Consequently, the most practical way of controlling the insect is by means of cultural operations. Another point which makes the cultural operations more feasible, is the fact that the insect confines its ravages almost entirely to the low, moist bottom lands. Consequently, on such low lands that are expected to be troubled with bud-worms, planting corn should be delayed until the young bud-worms have begun pupating. If planted at this time, in favorable seasons, the soil will be warm, and the young corn will come up and grow off without being stunted. The corn will have become too far advanced for serious injoury before the second generation of budworms can possibly get in their work.

Section	Time of Planting
Lower Soufh Carolina	May 5th
Middle South Carolina	„ 12th
Piedmont Region	„ 19th.

The above table shows the approximate dates for planting corn in various sections of the State, so as to escape the injury occasioned by the Southern corn-root worm. The date of planting for middle of South Carolina may be changed slightly when the records are more complete. Observations show that Camden and Marion are in the same pupation zone, while Spartanburg is two weeks later than Marion.

1696 – *Botys silacealis*: an Insect Injurious to Maize in Russia.

STRIELZOV, J. Kukurusnii Motilek (*Botys silacealis Hb.*). — *Khosiaistvo* (The Farm), Year 7, No. 37, pp. 1196-1208 and No. 38, pp. 1224-1228. Kiev, September 27, 1912.

In the course of the last few years, the progressive extension of maize cultivation has been attended by the increase of a most destructive insect, *Botys silacealis*. In the district of Bakumut, the number of plants attacked exceeded 20 per cent. in 1909 and 90 per cent. in 1912. Towards the middle of June, the females lay their eggs in large numbers on the leaf-blades, and the larvæ, which hatch out towards the end of July, penetrate into the interior of the stems and of the axes of the inflorescences and feed on the tender medullary tissues, excavating long galleries. The full-grown larvæ pass the winter inside the stems among their excreta and the plant débris, and pupate in the spring. Besides maize, *Botys sila-*

cealis frequently attacks hemp and millet. The plants injured by the larvae have very weak stems, which are bruised and broken by a touch; the ears are irregularly developed, the caryopses usually become abortive and the whole plant withers.

All varieties of maize are subject to the attacks of this insect. Observations made last year at the Kamen Experimental Station gave, for the chief varieties, the following percentages of the plants more or less attacked: Brown-County, 94; Minnesota No. 23, 88; Bessarabskaia, 88; Sterling, 56; and Cinquantino, 85. At the time of ripening, 100 specimens of Sterling were gathered and divided into three groups according to the nature and characters of the injuries they had suffered. In the first group were placed the plants slightly attacked at the base or summit, but of which the ears were untouched; in the second group were put those which were so much injured that the regular development of the ears was prevented; and the third included specimens in which the larvæ had also invaded the inflorescences.

1st group.	Slightly injured.	27 plants
2nd »	Moderately.	41 »
3rd »	Much	32 »

Instead of decreasing, the destruction caused by this pest increases from year to year.

Amongst its natural enemies are mentioned a fly, which has not yet been identified, the larvæ of which devour the caterpillars and pupae of *Botys silacealis*.

Good results are obtained by uprooting the plants after harvest, removing them carefully from the fields, and burning them in the autumn or spring.

1697 – Report on Disease of Paddy Plants at Agalawatte, Ceylon.

GREEN, E. ERNEST, in *The Tropical Agriculturist*, Vol. XXXIX, No. 3, pp. 195-196. Colombo, September 1912.

The writer, Government Entomologist, has inspected the Agalawatte region, where the rice fields had been infected by an insect pest identified by him as *Nilaparvata greeni* (Homoptera). The disease was first noticed about the beginning of July, when the stalks of the plants began to show a reddish tint. By the middle of that month, the stems were seen to be covered with insects in various stages of development. This condition continued for about three weeks, by which time the plants were dead and the insects had disappeared. No such pest had been observed in the locality before. Whereas there had been promise of a record crop, many fields, and large patches in others, have been completely ruined. Three-months paddy suffered less severely than five-months paddy. This may

probably be accounted for by the maturing of the more rapidly growing plants before there had been time for the development of a second much greater and more serious brood of the insects.

The writer recommends the burning *in situ* of the stubble and dead plants ; the careful watching of the subsequent crop and the eventual burning of the first isolated patches of infection ; and the destruction of the migrating winged forms by means of trap-lamps. In the event of continuous recurrences of the pest, it may be advisable to abandon for a time the cultivation of five-months paddy, in favour of those varieties that ripen more rapidly.

Nilaparvata greeni is a common species in the Kandy district, but has not been recorded as a pest there. The species is known only from Ceylon.

1698 – **Recent Studies on the Insect Pests affecting Sugar Cane, Cacao and Coconut Palm in Trinidad and Tobago.**

1. URICH, F. W. Insects affecting the Sugar Cane in Trinidad.
2. GUPPY, P. L. Cacao Pests.
3. URICH, F. W. Coconut Palm Insects in Trinidad.

Department of Agriculture, Trinidad and Tobago: Bulletin, Vol. XI, No. 70, pp. 26-29 ; 36-46 ; 70-72. Trinidad, 1912.

I. *Insects affecting the Sugar Cane in Trinidad.*

1. *Borers in the Stalk and Root Stocks. — Castnia licus* (1), although not so prevalent as in Demerara, British Guiana, causes serious injury. Generation is continuous. The only control that has been tried in Trinidad is the catching of the adult. In one estate 182 734 of them were caught in 1909, 116 707 in 1910, and 89 768 in 1911 ; about 60 per cent. of the total number were males.

Diatraea saccharalis, D. canella and *D. lineolata* are common in all the cane-growing islands and in Demerara ; conditions, however, vary in each place. The only control employed in Trinidad for moth-borers is the cutting out of dead hearts.

Rhynchophorus palmarum (2) is not of much importance. *Metamasius hemipterus* is fairly common but appears to be a pest of secondary nature. *Xyleborus perforans* is found only in canes fermenting owing to fungus attacks or any other cause. A species of *Aspidiotus* occurs on the stalk low down near the ground. The few specimens collected were affected by a parasitical hymenopteron.

II. *Insects affecting the roots. — Cercopidae* or Froghoppers (3), which are the cause of the so-called " cane blight ", have proved to be the most

(1) See No. 353, *B.* Jan. 1911 (*Ed.*)
(2) See No. 1977, *B.* June 1911. (*Ed.*)
(3) See No. 1584, *B.* May 1911. (*Ed.*)

injurious pest of late years. The species doing damage in Trinidad is *Tomaspis varia*, which appears to be indigenous tot he island. In Mexico the injurious species is *T. postica*, which also occurs in Britsh Honduras; n Panama it is *T. lepidior*; in Denmerara an apparently undescribed species. In Mexico a Reduviid bug, *Castolus plagiaticollis*, preys upon the adult stage of *Tomaspis*, and the writer is now trying to introduce it in Trinidad. The adult stage of the froghopper is attacked by *Metarrhizium anisopliae*; under favourable weather conditions the infection can be artificially propagated.

III. *Insects affecting the leaves.* — *Stenocranus* (*Delphax*) *sacchari-vora* rarely does any damage; it is not numerous and appears to be well kept in check by natural enemies. Among these the writer bred a species of a Drynid (a hymenopterous parasite of Fulgorids). The caterpillars observed in Trinidad are: *Caligo saltus*, several species of Hesperids, *Cirphis humidicola* and *Remigia repanda*; the scale insects are: *Pseudococcus calceolariae* and *P. sacchari* and a species of *Pulvinaria*; a grasshopper is *Neoconocephalus guttatus*. The damage they do is not considerable, as they are not very numerous and are often kept in check by predatory and parasitical enemies.

The writer remarks that owing to the difficulties in applying direct remedies on cane plantations the only reliable method of controlling the cane insect pest is the propagation of their natural enemies. Therefore he suggests that cooperative investigations in Demerara and the West Indies should be carried out with a view of ascertaining not only the biology of the pests but principally the status of their natural enemies.

2. *Cacao Pests* (1). — Attention continues to be paid in Trinidad to the cacao beetle (*Steirastoma depressum* L.). Apart from "chataigne maron" or wild chataigne (*Pachira aquatica*) and silk cotton (*Eriodendron anfractuosum*), other food plants of this pest are ochroe or okra (*Hibiscus esculentus*), forest omaho (*Sterculia caribaea*), cannonball tree (*Courupita guianensis*); seldom attacked are bois immortel (*Erythrina umbrosa* and allied species) gemauve (*Malachra capitata*), hog-plum (*Spondias lutea*) and mataple (*Clusia* spp.). But the main attraction is the cut wood of the wild chataigne, which has resulted in its successful use for trapping the cacao beetles in large numbers. Traps, composed of branches and bark of this tree, and the chataigne tree itself especially if "ring - barked" to a height of about 5 ft., have continued to prove most practical and effective. Large numbers of eggs are laid in the fresh bark of the trapwood, which dries up so thoronghly in a few days

(1) See No. 354, *B.* Jan. 1911; see also: *Board of Agriculture, Trinidad*, Circular No. 1, May 9, 1911. (*Ed*).

that the eggs and young larvae perish. Wherever clearings are being made in cacao, or wild chataigne trees are cut down, the trunks and branches on the ground must be burnt within two months, not before, as they will so serve as trapwood. Cacao has been often grown under chataigne shade ; where possible this shade tree should be removed, or only a certain number (20 to 25 are sufficient) reserved for trapwood purposes. The safest method of removing chataigne trees is to ring-bark them. Chataigne planted for trapwood should be placed in situations where the trees can be under constant observation.

Systematic trapping of the cacao beetles on a large scale was commenced about the latter part of 1911 with the following results:

Locality	Date from	Date to	Number of Beetles caught
Caroni	August 23,1911	Dec. 15,1911	11 000
Oropuche-Sangre Grande	» 23,1911	» 15,1911	5 000
Caura	June 17,1911	» 16,1911	13 416
		Total	29 416

The weather in 1911 was favourable for the pest. The biggest catches were made from the end of September to the middle of October. Subsequently to the systematic trapping in Caura the visible signs of attacks have been greatly reduced. The cost of collecting is 40 to 46 cents per hundred and may go as low as 15 cents.

All birds, especially those of the wood-pecker type, and lizards and snakes prey upon the cacao beetle. Among insect enemies of the cacao beetle there are two Ichneumons and the larvæ of certain Elaters ; their value as natural enemies is now being investigated.

An extensive and severe epidemic of cacao thrips (*Heliothrips rubrocinctus*) has been reported (December 1911-January 1912) at Sangre Grande. There are former records of attacks in Trinidad, but the present epidemic is the most extensive on record. The thrips causes loss of leaf, and consequently drying of young pods and loss of a large percentage of the crop. Dry weather and no shade conditions seem most favourable to the insect. As control measure kerosine emulsion of the formula

Kerosine	2 gallons
Water	1 gallon
Hardsoap	½pound

one gallon to be diluted in 50 gals. water, has been recommended for spraying trees (1) and has been successfully tried by the writer. For this spray-

(1) *Board of Agriculture, Trinidad, Circular* No. 3. August 9, 1911. (*The writer*).

ing it is absolutely necessary to have a machine which keeps the contents constantly agitated. The cost of two applications of spray would be about 2 cents per tree, assuming that about a gallon of mixture is used for each tree.

The writer has not been able to verify that the thrips attack immortels. They are fond of cashew, mango and almond (*Terminalia Catappa*). These trees, which harbour thrips all the year round, should not be grown near cacao, unless they are thoroughly sprayed two or three times a year.

Leaf-eating beetles (*Chrysomelidae* mostly) have again become very troublesome feeding on young leaves (1).

Podhoppers (*Horiola arcuata* and allied species) cause a certain amount of damage in some localities, but this happens only where the ants, principally those of the genus *Azteca* are abundant. Of course, parasol ants are well known and important pests of cacao, but these have been controlled effectively for some years past by the use of carbon bisulphide. Various other species of ants play an important part in the spread of Coccids, Aphids, Membracids and such-like sucking insects found in cacao (2).

The following is a preliminary list of insects affecting the cacao tree, arranged more or less in order of importance.

(1) Numbers of these leaf-eating beetles can be easily killed by jarring them off into basins or buckets or even calabashes containing crude petroleum. Spraying with arsenate of lead (4 lbs. to 50 gals. water) is recommended. (*Board of Agriculture, Trinidad, Circular* No. 3).

(2) The eggs of the podhopper are laid on the stems of pods or on the pods or on young shoots of cacao, mostly in clusters from 50 to 100, about 2/3 of each egg being pushed well within the plant tissues. Podhoppers in all stages pump out the juices of the cacao pods with their proboscids. Not only are they protected by several species of ants which collect the supplies of juice exuding from the podhoppers, but they are cultivated and housed within the ants' nests. *Uscanella bicolor*, *Trichogrammatella tristis* and *Tumidiferum pulchrum* are useful hymenopterous egg - parasites of the podhoppers. But they are unable to get at the eggs of the podhopper wherever the ants have built their galleries over the eggs. Therefore to control the pest the ants must first be destroyed. A strong kerosine emulsion or resin compound should be used for this purpose. Carbon bisulphide is a good insecticide for most ants nests in ground.

A preliminary list of Trinidad ants comprises 69 species with the genera *Ectatomma*, *Platythyrea*, *Pachycondila*, *Ponera*, *Leptogenys*, *Anochetus*, *Odontomachus*, *Eciton*, *Psendomyrma* *Monomorium*, *Solenopsis*, *Megalomyrmex*, *Pheidole*, *Crematogaster*, *Tetramorium*, *Crytocerus*, *Strumigenys*, *Apterostigma*, *Cyphomyrmex*, *Sericomyrmex*, *Atta*, *Dolichocerus*, *Azteca*, *Tapinoma*, *Brachymyrmex*, *Prenolepsis* and *Camponotus*. The genera *Azteca* and *Dolichoderus* stand out prominently. Of the 6 species of *Azteca* living on cacao estates, *A. chartifex* appears to be the most injurious: it has been found associated with *Horiola arcuata* and allied species, *Dactylopius citri* and *Lecanium nipae*. *Board of Agriculture, Trinidad, Circular* No. 3, pp. 5-6 15-18. Trinidad, 1911 (*Ed.*).

Scientific Name	Popular Name	Remarks, etc.
1. *Steirastoma depressum*	Cacao beetle	Circular * No. 1
2. *Heliothrips rubrocinctus*	Thrips	Circular Feb. 24, 1911
3. *Horiola arcuata* and variety	Podhopper	Circular No. 3, pp. 5-6
4. *Necbrotica* sp.	Leaf-eating beetle	» pp. 3-4
5. » »	»	» »
6. *Colaspis* sp.	»	» »
7. *Diabrotica* sp.	»	» »
8. *Rutela lineola*	»	» »
9. *Brachyomus tuberculatus*	»	» »
10. *Ancistrosoma farinosum*	» (Chafer)	» »
11. *Lachnosterna patens*	» (Large Chafer)	» »
12. *Otiorhynchus* sp.	» (Weevil)	» »
13. *Pelidnota* sp.	»	» »
14. *Aphetea inconspicua* Fowl.	Podhopper (Green)	» »
15. *Endoiastus caviceps* Fowl.	»	» »
16. *Trachyderes succinctus*	Longicorn beetle	» »
17. *Ecthoea quadricornis* Oliver	» » (Twig girdler or Cacao pruner)	
18. *Endesmus grisescens* Savt.	Longicorn beetle (Girdler)	
19. *Xyleborus perforans*	Shot borer	
20. *Platypus* spp.	» »	Proceedings Agr. Society Trinidad Tobago, April 1911, Paper No. 459.
21. *Dactylopius citri*	Mealy bug	Cacao pods mostly.
22. *Aspidiotus latanae*	Nipple scale	W.I. Com. Cir. 23/11/1909.
23. *Aspidiotus destructor*	» »	»
24. *Lecanium* sp.	Brown scale	»
25. *Aphis* sp.	Black aphis	»
26. *Aleyrodes* sp.	White fly	»
27. *Embia urichii*	Spider-web insect	»
28. *Embia trinitatis*	» »	»
29. *Azteca* sp.	Balata ants	Circulars 3 & 5. Proceedings Agr. Soc., April 1911.
30. *Atta cephalotes*	Parasol ants	
31. *Atta octospinosa*	» »	

(*) Circulars quoted refer to publications of Board of Agriculture, Trinidad.

3. *Insect Pests affecting the Coconut Palm in Trinidad* (1). — A. *Beetles boring in the Stem.* The palm weevil (*Rhynchophorus palmarum*) has always been credited with being most destructive to coconuts, but with few exceptions is generally a secondary pest, following fungoid disease or attacking trees that have been damaged or are growing under unfavourable conditions, and in consequence weakened. The female beetles ap-

(1) See *No.* 598, *B.* March 1912. (*Ed.*).

pear to be attracted by the acetic fermentation which takes place in diseased trees. Young trees up to 4 or 5 years are those mostly attacked. Full grown trees are not touched. It has been observed that when young trees are growing in old cultivations, the falling leaves of the tall trees sometimes damage the tender leaves of the small ones and so open the way to beetle attack. In all cases of attack on healthy trees the writer has noticed that young trees were growing under tall ones. The part of the stem selected is generally the soft tissue near the top and at the bases of the leaves; the larvæ sometimes eat into the petiole of the leaf when it is fairly young. The preventive remedy consists in tarring wounds.

The bearded weevil (*Rhina barbirostris*) attacks full or half grown trees. The damage is done by the larvæ, which bore galleries in the hardest part of the stem. Like the palm weevil the bearded weevil is attracted by fermentation: trees suffering from bud-rot are attacked at the top, and those affected by root disease (1) at the base of the stem. Besides diseased trees, this weevil attacks trees that have been scorched. The methods of control adopted have been preventive and consist in tarring the stem of the trees that have been scorched. A mixture of white lime to which is added 5 lb. of arsenate of lead to every 50 gls. of solution is also used.

Ambrosia beetles (*Xyleborus perforans* and allied species) attack trees under the same condition as the bearded weevil. The beetles *Metamasius hemipterus*, *M. cinnamominus* and a species of *Rhodobaenus* attack trees under much the same conditions as the palm weevil and are often found associated with it.

B. Insects affecting the leaves. — There are quite a number of caterpillars, Coccidæ and Aleyrodidæ to be found on coconut leaves, but with one or two exceptions none of them do any damage. *Brassolis sophorae*, the coconut butterfly, cannot be considered a pest in Trinidad, where it is kept in check by a Tachina fly. The following Coccidae have been observed: *Icerya montsesrratensis*, *Pseudococcus nipae*, *Vinsonia stellifera*, *Pinnaspis buxi*, *Aspidiotus destructor*. The first four species are kept in check by predaceous beetles and hymenopterous parasites, but the last-named coccid does damge occasionally. It is only injurious when

(1) Root disease is always characterised by discoloured roots and a distinct red ring of tissue in the stem. Stockdale has attributed this disease to a species of *Diplodia*, but work carried out Trinidad in 1910 and 1911 points to the conclusion that physiological conditions, rather than any specific organic parasite, are responsible for the trouble. See RORER, J. B., Report of Mycologist for Year ending March 31, 1911 (Part II). *Board of Agriculture, Trinidad, Circular*, No. 4, pp. 27. October, 20, 1911. RORER, J. B., Bud rot of the Coconut Palm — *Department of Agriculture Trinidad and Tobago Bulletin*, pp. 68-69, January-June 1912. (*Ed*).

associated with the ant *Azteca chartifex*. Some spraying experiments have shown that commercial lime-sulphur used in the proportion of 1 to 15 will free a tree from ants for 6 months, and that arsenate of lead in the proportion of 5 lb. to 50 gals. water acts as a preventive against them.

C. *Beetles affecting young plants.* — The insect locally called rhinoceros beetle (*Strategus anachoreta*) is occasionally injurious to young plants by burrowing from beneath into the soft tissues of the plant and destroying the bud. It has never been known to attack a plant above ground. An application of lime around the trees after planting out appears to protect them.

D. *Relation of Insects to Bud-rot.* — The fermenting tissues of a coconut palm affected by bud-rot attract quite a number of insects, but so far no observations of direct transmission of the disease by insects have been made. The palm and bearded weevils have often been mentioned in connection with bud-rot, but they are never found in the rotting bud. The insects more likely to transmit the disease are the scavenger flies whose larvae live in the decomposed bud. Trees affected by bud-rot are generally burnt or buried.

1699 - The Narcissus Fly. (1)

LONG, H. C., in *The Gardeners' Chronicle*, Vol. LII, No. 1346, pp. 278-279. London, October 12, 1912.

The species *Merodon equestris* Fabricius (*Syrphidae* family) of which there are three varieties, namely *narcissi*, *validus* and *transversalis*, has become a most serious pest of Narcissus bulbs in Great Britain, and is very widely distributed. *M. claviceps* Meingen has also been recorded as attacking Narcissus bulbs, so that doubt is thrown on the accuracy of the identification of this species.

An extensive attack of *M. equestris* was recorded from Cornwall, in October 1896; since that time, with the great increase in the growth of Narcissi in Great Britain, the Narcissus fly has become so widely distributed that it occurs almost wherever these bulbs are grown in the country. It is commonly held that it was introduced into England from Holland, but Theobald believes that "it has always existed as a native insect amongst the wild Daffodils in the west and other parts of the country" (*Report on Economic Zoology for the Year ending September* 30, 1911, *Journal S. E. Agric. Coll., Wye*, pp. 107-117).

The pest was first noticed in 1738 in France; in 1840 in Holland. It has been introduced into Canada on bulbs imported from Holland and

(1) See No. 3054, *B.* Aug.-Sept.-Oct. 1911; Nos. 3260 and 3271, *B.* Nov.-Dec. 1911; and No. 1676, above. (*Ed.*).

probably also from Spain and now it is prevalent in British Columbia and in Ontario. In Holland the fly chiefly attacks *Narcissus tazzetta* and Jonquils. In British Columbia the early varieties of Daffodils, such as Golden Spur and Henry Irving are not attacked, but such varieties as *N. poeticus ornatus* and *N. poeticus poetarum* suffer considerably. In England the fly is imported every year in Dutch bulbs in great numbers and has been recorded as attacking bulbs of Hyacinths, Tulips, Narcissi, Galtonias, wild Hyacinths or Bluebells, Atamasco Lilies (*Habranthus pratensis*), Scarborough Lilies (*Vallota purpurea*), Liliums, Hippeastrums.

Descriptions are given of the adults, of the larva and of the life history.

The eggs are laid on or near the bulbs between the months of May and July; the resulting grubs eat their way into the bulbs; the larvae feed and grow in the bulbs, remaining in them for some months, finally pupating in the soil from about March to May and giving rise to the flies in May and June.

The following preventive or remedial measures are advised: Lifted bulbs should be carefully examined before planting and all infested bulbs should be burnt. Beds in which attacked bulbs have been grown should be deeply dug several times and lime may usefully be dug in. The flies should be caught with a net when they settle, and crushed; or they may be trapped by placing plates filled with treacle, and the edges smeared with honey, near the bulbs. If bulbs could be placed for 20 minutes or half an hour in water kept at a temperature of 115° F., the heat would probably kill the grubs without harm to the bulbs. Theobald writes (1911 Report) as follows: " Ritzema Bos suggests soaking the bulbs which are suspected for eight days in water, so as to drown the grubs. Some I treated in this manner did not yield good results ".

1700 – *Hilipus bonelli*: a New Enemy of the Fig in Brazil.

BONDAR, GREGORIO. Una praga da Figueira (*Hilipus bonelli*). — *Chacaras e Quintaes*, Vol. VI, No. 3, pp. 7-8. San Paulo, Brazil, September 15, 1912.

The insects which are injurious to the fig-tree (*Ficus carica*) in Brazil are not numerous; they consist chiefly of *Azochis gripusalis*, popularly known as " lagarta ", which destroys the buds and young fruits, and *Trachyderes thoracicus*, whose larvæ tunnel galleries in the trunks.

To these may now be added *Hilipus bonelli*, which has been observed by the writer on the fig-trees and in the apple orchards of Campinas. The larvæ make galleries in the trunks and branches, whence they emerge to fly about in the adult stage. They have two biological cycles in the year. The damage they effect is great, for the tree, when attacked, is killed and the insects spread rapidly.

The writer advises as a remedy, spraying with soluble carbolineum, and as a preventive measure, the removal and destruction of the diseased trunks and branches.

The writer found that all the parasites of *Ficus carica* in Brazil (this tree was imported to that country from Europe) are also parasites of the indigenous wild fig (" figueira brava "). Thus he observed some examples of *Urustigma*, which were attacked either by *Azochus gripusalis* or by *Hilipus bonelli*. He thinks, therefore, that the parasites of the indigenous wild figs have adapted themselves to *Ficus carica*, which has been imported to Brazil and there acclimatized.

1701 – **The Willow Tree Caterpillar (*Angelica tyrrhea*, Cramer): a Destructive Pest in Forest Plantations.**

HARDENBERG, C. B. in *The Agricultural Journal of the Union of South Africa*, Vol. IV, No. 3, pp. 397-418. Pretoria, September 1912.

Wherever in the Union of South Africa willows are grown as ornamental trees, especially the weeping willow (*Salix babylonica* L.) the willow tree caterpillar (*Angelica tyrrhea* Cramer, Order Lepidoptera, family Saturniidae) is well known as a most destructive pest, periodically stripping the trees of their foliage. Of late years the pest has become more important on account of its attacks upon other cultivated and more valuable trees. The occurrence of this pest in South Africa has been recorded several times and in various parts of the Colony, since 1891-92 and on a great variety of plants including : willow, poplar, thorn trees (*Acacia* spp.), wattle, pine (*Pinus insignis*), pepper-tree, apple, quince, blauw bosch, wild seringa, oaks, pumpkin, lucerne, fruit trees, veld plants ; while the following have been reported to be immune : — *Pinus pinaster*, *P. halepensis*, *Cupressus macrocarpa*, *C. sinensis*, *C. leptoclada*, pear. Of the food-plants above reported the first three are preferred.

The insect is indigenous to South Africa, and its distribution is confined to the Aechiopian region. Its original food plants appear to be several species of *Acacia* (especially, *A. horrida* and *A. caffra*). In some localities the pest has been noticed in abundance for a number of successive seasons ; in others it suddenly disappears after a season of extreme abundance. This is generally ascribed to the corresponding increase in numbers of its parasites ; but this theory is not based upon reliable facts.

The writer gives detailed descriptions and illustrations of the egg, of the six stages of the caterpillar, of the pupa and of the adults. The season history may be summed up as follows. Moths appear from the end of September to the middle of October ; eggs are hatching during October, the larvae remaining until the middle of January, when pupation takes place, which lasts until the end of September. A small second brood of moths emerges generally towards the end of January

and during February, but the further history of this brood has not been worked out. The eggs are deposited in clusters attached to the terminal twigs of the host plant; the caterpillars remain quiet during the day and feed at night; the full grown larvae crawl underground, generally at the base of the tree, to pupate; the large conspicuous moths emerge in the evenings of early spring, just after the first rains have fallen. One female moth may lay from 250 to 400 eggs.

A recent case of very serious damage was brought to the notice of the wr ter in January 1911, in a large plantation of *Pinus insignis* and other forest trees near Vereeniging, Transvaal.

Means of Control. — One is still far from a satisfactory solution of the problem of the control of this insect. Natural enemies cannot be depended upon. The egg parasites (two minute wasps) are very local in their distribution; a fungus attacking the caterpillars and the pupae could not be successfully reared; no birds or other insectivorons animals are known to prey upon either the caterpillars or the moths. Spraying, though effective, is only practicable in cases of recent infestation. Mechanical destruction of the insect in all its stages is the only method which at present can be relied upon as being effective

1702 - Willow and Poplar Leaf Beetles.

MAC DOUGALL, R. STEWART, in *The Journal of the Board of Agriculture*, Vol. XIX, No. 7, pp. 554-560. London, October 1912.

Certain species of the family Chrysomelidae claim the attention of the forester owing to the destructive work of the adults and larvae on trees. The writer describes three genera, *viz. Galerucella*, *Phyllodecta* and *Melasoma*.

Of the genus *Galerucella* there are seven species in Britain, two of which, *G. tenella* and *G. lineola*, feed on willow. The latter is the cause of great loss to osier plantations in England; it has also been sent to the writer, for determination, from Ireland, as destructive on willow.

Of the genus *Phyllodecta* there are three British species, *viz. P. vitellinae*, destructive to willow and found also on poplar and alder; *P. vulgatissima*, destructive on willow and also found on poplar; and *P. cavifrons*, not so common as the others, and found on aspen and black poplar.

Of the *Melasoma* species, *M. populi* is found on young poplars and on willow, and *M. longicolle* on aspen and goat willow. A third species *M. oeneum*, is found on alder.

G. lincola. *P. vitellina* and *P. vulgatissima* are of distinct economic importance. These three species pass the pupal stage in the soil; *M. populi* and *M. longicolle* in their pupal stage are attached to the under side of the leaf.

ALFREDO RUGGERI, *gerente responsabile*.

I. A. R. I. 75

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